



Developing a DSS for Allocating Gates to Flights at an International Airport

Vincent F. Yu, National Taiwan University of Science and Technology, Taiwan

Katta G. Murty, IOE, University of Michigan, Ann Arbor, USA

Yat-wah Wan, GSLM, National Dong Hwa University, Taiwan

Jerry Dann, Taiwan Taoyuan International Airport, Taiwan

Robin Lee, Taiwan Taoyuan International Airport, Taiwan

ABSTRACT

Typically international airports have features quite distinct from those of regional airports. We discuss the process of developing a Decision Support System, and appropriate mathematical models and algorithms to use for making gate allocation decisions at an international airport. As an example, we describe the application of this process at Taiwan Taoyuan International Airport to develop a DSS for making gate allocation decisions for their passenger flights.

Keywords: airport operations; DSS (decision support system); gate allocations to flights; international airport

INTRODUCTION

The problem of assigning gates to flights of various types (arrival, departure, connection, and intermediate parking flights) is an important decision problem in daily operations at major airports all over the world. Strong competition between airlines and increasing demand of passengers for more comfort have made the measures of quality of these decisions at an airport as important performance indices of

airport management. That is why mathematical modeling of this problem and the application of OR (Operations Research) methods to solve those models have been studied widely in OR literature.

The dynamic operational environment in modern busy airports, increasing numbers of flights and volumes of traffic, uncertainty (random deviations in data elements like arrival, departure times from flight time tables and schedules), its multi-objective nature, and

its combinatorial complexity make the flight-gate allocation a very complicated decision problem both from a theoretical and a practical point of view.

Responsibility for gate allocations to flights rests with different agencies at different airports. At some airports gate allocation decisions are made by the airport management themselves for all their customer airlines. At others, some airlines lease gates from the airport on long term contracts. Then those airlines make gate allocation decisions for their flights themselves.

Typically international airports have features quite distinct from those of regional airports. The common characteristics of busy international airports all over the world are: they usually serve a large number of different airlines; they normally serve a large number of flights spreading over most of the 24-hour day; they have to accommodate planes of various types and sizes, and a considerable percentage of their flights are long haul flights coming from long distances. These features, and the fact that international airports are much bigger and have much higher volumes of traffic compared to regional or domestic airports, make the problem of assigning gates to flights at an international airport somewhat harder in practice than that at a regional airport.

In this article we discuss the process of developing a DSS (Decision Support System), and appropriate mathematical models and algorithms to use for making gate allocation decisions at an international airport. Normally international airports have both cargo and passenger flights, but in this article we will only consider gate allocation decisions for passenger flights.

As an example, we describe the on-going work being carried out to develop a DSS at TPE (Taiwan Taoyuan International Airport), the busiest international airport that serves all of Taiwan; to help the team of Gate Allocation Officers make their decisions optimally and efficiently.

Being the busiest airport in Taiwan, TPE has all the characteristics mentioned above. Here is a quick summary on the most important

characteristics for the gate allocation decision at TPE. TPE serves about 40 international airlines, gate allocation decisions for all the flights at this airport are handled by the airport itself. TPE has a team of 18 flight operations officers (working three shifts) responsible for these decisions.

TPE handles on average about 420 regularly scheduled flights/normal working day (this average varies from 390 to 450/day), and 20 irregular (i.e., unscheduled) flights/day (this average varies from 10 to 40/day); depending on the day of the week. Friday is usually the busiest day of the week, and holidays (Saturdays, Sundays, and other national holidays) are also busy days in comparison to the other working days. The Chinese (Lunar calendar) New Year vacation (which usually occurs in the months of January or February) days are the busiest days of the year at TPE. The number of flights some days before and after the Chinese New Year may be well over 500. A more complete description of the gate allocation problem at TPE is given in the next section.

We describe the procedures being used currently at TPE, the mathematical models being developed, and procedures that will be used to solve these models when the DSS is fully implemented, and the expected benefits. We will discuss important design features of the DSS and how it will be incorporated into daily operations.

THE NATURE OF THE GATE ALLOCATION PROBLEM AT TPE

TPE is located approximately 40 kilometers south of Taipei City, the capital and the largest city of Taiwan. Currently there are two terminals at the TPE.

Terminal 1 started operations in 1979, in a period of the most dramatic economy growth in Taiwan history. As a result, the traffic volume at the TPE grew rapidly and soon exceeded its original designed capacity. The situation was

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