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RESOURCE MANAGEMENT SYSTEM – THE FIRST STEP TO THE AIRPORT INFORMATION SYSTEM INTEGRATION

Zsolt KELEMEN

Department of Application Management
H–1675 Budapest Ferihegy International Airport, Hungary
Phone: (+36) 1 296-6807, Fax: (+36) 1 296-5290
e-mail: zsolt.kelemen@bud.hu

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Abstract

The deregulation in the field of ground handling services has brought a new situation for airport companies. They imperatively have to make even stronger efforts regarding customer-friendly services. The new situation requires the management should move from traditional package arrangements towards offering services particularly tailored to suit the customers' specific needs. That is why the effective information management has become an important competitive factor.

Managing airport resources is fundamental for the successful management of an international airport. The best solution is to develop a well-structured Resource Management System. A Resource Management System is the solution for the efficient management of handling mobile and immobile resources, what could be a first major step to the integration of a central airport operational database system.

This paper provides details on Resource Management System and the latest available user-friendly solutions.

Keywords: air transport, Resource Management System, integrated information system.

1. Introduction

In today's rapidly changing airport business environment, challenges have continued to increase for IT infrastructures because of the widening variety of hardware, operating systems, software packages, database platforms, development tools, and communication protocols.

Increasingly, the air traffic market requires greater efficiency in the deployment of resources. To ensure that the capacities of check-in desks, departure lounges, gates, aircraft stands, baggage carousels, staff and equipments are available as needed, airports require comprehensive information around-the-clock on the expected resource demand and on the current traffic and allocation situation.

2. The Goals of Establishing a Resource Management System

The objective is to enable the check-in process, capacity control and dispatch of flights to be done more efficiently than it is possible by manual methods and at least

economically. The deploying of a Resource Management System will help airports to achieve the following business goals:

- Optimizing the current resources;
- Providing an overview of the resource allocations covering the entire day;
- Maximizing the runway and airport capacity;
- Identifying and alerting of potential bottlenecks and providing conflict resolution;
- Attracting new traffic by offering off-peak service and pricing package for low cost carriers;
- Cutting workload of scheduling managers in optimizing handling capacities;
- Allowing user modifications to accommodate the airport-specific business processes by flexible maintenance of business rules;
- Enhancing the overall service quality (punctual departures, cost competitiveness and reliability);
- Optimizing the cost of operation by levelling the resource utilization and enabling an effective process control for all aircraft turnaround on the airport;
- Consequently growing the top line income, and optimizing revenue.

Furthermore by implementing a Resource Management System airports will no longer need to store the same data on a number of different systems, that is why it is a basic step in the information system integration process.

3. Resource Management System Functionality

A Resource Management System supports the scheduling of flights, check-in desks and associated departure lounges, all stand from the pier-served stands to remote stands, gates, baggage carousels, together with staff and mobile equipments.

There are 5 main modules commonly attached in a typical Resource Management System:

1. Check-in allocation module
    - Ticket Desks
        - Flight Check-in
        - Common Check-in
2. Gate allocation module
    - Gates (including their associated departure lounges)
        - Arrival Gates
        - Departure Gates
        - Passenger Hold Room
        - Control of Boarding
        - Control of Doors
    - Stands (pier-served stands and remote stands)

  - Terminal Stands
  - Remote Stands
  - Hangar Positions

3. Baggage allocation module
    - Baggage Carousels
    - Explosive Detection Devices
4. Staff allocation module
5. Equipment allocation module

A Resource Management System has to include capability to allocate manually all these resources but the airport can benefit of added functionality from these applications as listed hereinafter.

3.1. Check-In Allocation

The Check-In Module allocates check-in desks to departing flights. It has to assign check-in positions based on defined rules. At check-in the demand curve can vary greatly, depending on the sequence in which passengers arrive.

A typical Resource Management System's Check-In Module

- optimizes the use of check-in allocations to lower the airport's costs, and offers best service to the airlines and their passengers;
- captures the knowledge of airport operators into a set of rules which can reliably and equitably allocate check-in desks on a daily basis;
- uses schedule and real-time data via feeds from airlines sources, integrated systems, or by manual entry.

Check-In Module considers operational requirements and characteristics such as:

- mandatory desks for individual airlines;
- landside Common, Dedicated and airside Transfer desks;
- desk preferences for particular flights;
- passenger arrival profiles by class and time;
- expansion strategies for airlines/handlers (such as how the desks available should expand as passenger check-in peaks);
- handler and carrier preferences for aisles and desks.

Benefits include:

- dynamic allocation of check-in desks to meet changing requirements;
- maximized usage of desks in greatest demand;
- day-to-day consistency for improved operational efficiency;
- improved carrier and customer satisfaction resulting in increased business opportunities and ultimately increased revenue.

Latest check-in solutions incorporate the latest PC capabilities to help airport staff to perform both simple and difficult passenger check-in transactions. [1] For example, graphical windows-style presentations simplify the passenger check-in. User prompts, colour-coded screens, drop-down menus and dialogue boxes allow agents with minimal training to complete quickly passenger check-in.

3.2. Gate Allocation

A typical Resource Management System's Gate Module optimizes the use of gates, stands and parking positions to lower the airport's costs and to provide best service to the airlines and their passengers. The system captures the knowledge of airport operators into a set of rules which can reliably and equitably allocate gates on a daily basis. Gate Module assigns gate positions based on defined rules administered by the user. When demand exceeds supply, Resource Management System allocates a defendable fair share to each airline, handling agent or other entity.

Gate Module considers operational requirements and characteristics such as:

- gate passenger capacity,
- lounge area passenger capacity,
- security processing facilities,
- carrier/airline preferences,
- proximity to airline premium customer lounges,
- multi-use gates such as Schengen,
- aircraft and stand compatibility,
- remote stands versus stands with air-bridges,
- pushback conflicts,
- timing of consecutive aircraft on stands.

The benefits of using this application in the allocation of ground resources include:

- optimal management and allocation of resources;
- delay potential capital expenditure for additional resources by optimizing the usage of existing resources;
- cater for peak periods with the dynamic allocation and optimization of resources;
- reduce aircraft turnaround by ensuring that sufficient and practical resources are timely available to service flights;
- increase passenger flow through the terminals with the logical allocation of check-in desks and gates.

3.3. Baggage Allocation

The Baggage Allocation Module provides airports with a mechanism to handle arrival baggage carousel allocations. A typical Baggage Module considers operational requirements and characteristics such as:

- capacity and load of baggage carousels,
- varying number of arriving passengers on flights,
- airline preferences,
- domestic versus international arrivals,
- locations of stands and gates at multiple terminal buildings.

Benefits include

- quick and easy reassignment of baggage carousels to meet changing requirements;
- improved quality of service through minimized passenger waiting times;
- reduce passenger frustrations by making carousels available in time for arriving flights.

Baggage Module has to alert users of any conflicts that occur throughout the scheduled day.

3.4. Staff Allocation

A typical Staff Allocation Module is designed for the aviation industry to meet the challenges of rostering a large and diverse 24×7 workforce. The ability of Staff solutions to address changing circumstances within a business environment – quickly and effortlessly – is enhanced by the sophisticated, yet simple to use rule-base.

The Staff Module considers operational requirements and characteristics such as:

- automating the deployment of manpower while increasing staff utilization;
- streamlining the assignment of daily tasks and the rostering process;
- generating every task that must be completed during a roster period by using the flight schedule of an airline or airport, human resources and non-flight related task files;
- allocating appropriate resources to manage all tasks and providing a clear visualization of the day's tasks, shifts and staff.

Benefits include:

- increased staff utilization;

- substantial reduction in the staff-hours required to prepare and maintain rosters;
- significant reduction in the time taken to evaluate and respond to operational disruptions;
- reduction in idle time in staff rosters translating into a reduction of costs for airport operators.

3.5. Equipment Allocation

A typical Equipment Allocation Module is specifically designed for the aviation industry to meet the challenges of rostering a large and diverse range of equipment. The Equipment Module considers operational requirements and characteristics such as:

- automating and increasing the utilization of equipment resources;
- streamlining the assignment of equipment to ensure smooth management of the operation;
- allocating equipment for every task that must be completed during a roster period using the flight schedule of an airline or airport, and related task files;
- allocating an appropriate equipment to manage all tasks and providing a clear visualization of the day's requirements.

Benefits include

- increased equipment utilization;
- substantial reduction in the time taken to evaluate and respond to operational disruptions;
- reduction in idle time in equipment rosters translating into decreased costs.

4. Resource Management System Integration

Resource Management System, as the basic element of an integrated airport information system, has to use a knowledge base to make intelligent assignment of check-in desks, departure lounges, gates, stands, baggage carousel, staff and equipment resources for flights. The knowledge base has its own rules. The application has to use the rules to make automatic assignments and provide recommendations.

4.1. Rules

Airport resources are allocated according to pre-defined rules set in the system. There are two types of rules: hard and soft. [2]

- Hard Rules are based on conditions that must be met. Hard rules include items such as wingspan and width of an aircraft.
- Soft rules are preferences and not essential for the allocation of resources. Preferences can include items such as the preference of a stand.

The Check-In Allocation module has to contain at least the following rules:

- Capacity rules allowing allocation of desks for flights with passenger totals exceeding certain numbers;
- Out of service rules allowing to close desks for temporary or long-term;
- Resource assignment rules allowing the constraint on airlines, aircraft, destination, gate, stand, nature of flight (international/domestic) and type of flight (charter, commercial);
- Assignment rules that allow desks to be assigned for specific class of passengers.

The Gate Allocation Module rules define what can and what cannot be assigned to gates, stands and parking positions. The rules include:

- Stand Blockage – conditions when a stand is closed or out-of-commission.
- Minimum separation time – minimum allowable time between the times a departure pushes back from a stand and the next arrival parks at a stand.
- Conflict penalty – assigned to flights that are assigned to the same stand at the same time; conflict severity is calculated by multiplying the conflict penalty by the number of minutes of overlap.
- Overnight Usage Penalty – assigned to a flight that stays overnight.
- Push-back aircraft penalty – assigned to an aircraft that can move in reverse with assistance.
- International Arrival/Departure penalty – assigned to an international flight.
- Domestic Arrival/Departure penalty – assigned to a domestic flight.
- Airline priority – which airlines are given priority on stands, parking positions and gates.
- Fleet priority – which fleets at which stands can be accommodated.
- Handler priority – which handlers which stands prefer and other ground crew considerations.

The Baggage allocation module has to contain at least the following rules:

- Capacity rules allowing allocation of carousels for flights with passenger totals exceeding certain numbers.
- Out of service rules allowing to close carousels for temporary or long-term.
- Resource assignment rules allowing the constraint on airlines, aircraft, destination, gate, stand, nature of flight and type of flight.

The Staff allocation module has to contain at least the following rules:

- Labour laws and agreements.
- Legal shift sizes.
- Break assignments.
- Staff profiles/skills required by the different activities.

The Equipment allocation module has to contain at least the following rules:

- Service/Availability status.
- Temporary or long-tem out of service rules.
- Equipment locations by terminals.

4.2. The Model of an Integrated Resource Management System

A well developed Resource Management System has a complex connection with other systems, which can be seen in *Fig.1*. In the picture we can follow the suggested data flow.

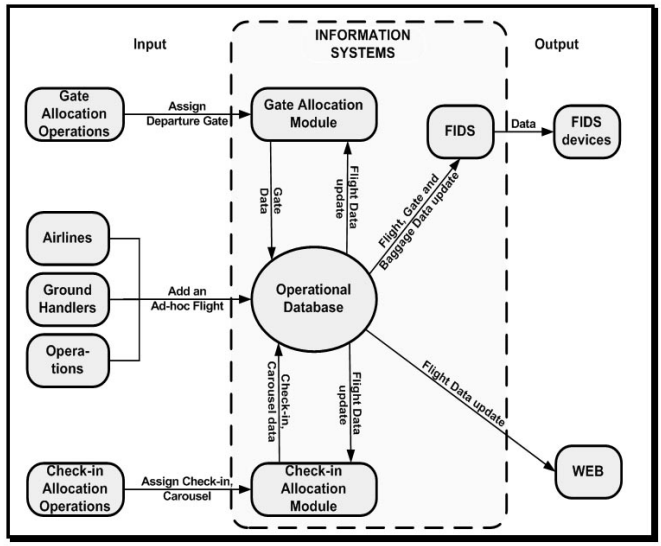

Fig. 1. Resource Management Data Flow Chart

The seasonal schedule is stored in the Central Operational Database. If there is an ad-hoc flight the first step will be the typing of the ad-hoc flight into the Central Operational Database by operations, by airline or by ground handler companies. Secondly the ad-hoc flight data updates the Resource Management subsystems automatically. The main step is the assignments. The operation field users assign the check-in desks, stands, baggage and equipments by using the system modules.

All the data have to be updated in the Central Operational Database, in order that passengers and airport services have the correct information through FIDS (Flight Information Display System) monitors or through the WEB.

4.3. User-Friendly Solutions

A modern Resource Management System has a graphic user interface. The primary tasks of a scheduling manager can be performed in a single window, the so called main window. The main window displays resource allocation in the form of bar charts (Gantt charts) that will be automatically updated in the event of changes to relevant information. The displayed information can be modified by means of mouse operations.

In order to satisfy the informational needs of the user at a given time, the size of each window must be altered by clicking and dragging its frame.

Fig. 2 shows a screenshot as an example of interactive Gantt chart. By using this possibility users can manually assign flights, represented by flight bars, to stands using a drag-and-drop method.

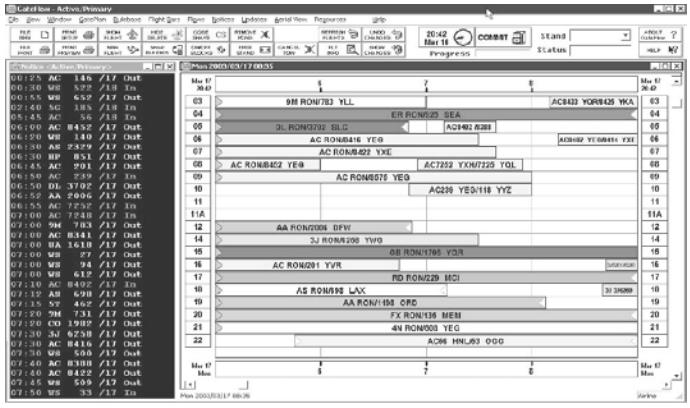

Fig. 2. Example of an Interactive Gantt Chart [3]

To gain a better overview of resource distribution, nowadays it is possible to display two Gantt charts on the display screen. [4]

Another user-friendly example is the Topographic Display as it is shown in *Fig. 3*. By calling up this function a bird's-eye view of the airport appears in a separate window. In operative mode, the current situation in the airport is automatically represented.

This concept has been designed to allow subsequent expansion of resource types for example gates, baggage carousels, or check-in desks. The expandability of other functions, such as incorporating video images has already been considered in the concept.

A very helpful function is Planning Mode. In order to conduct what-if scenarios in this mode, using resources that do not actually exist, the system can be

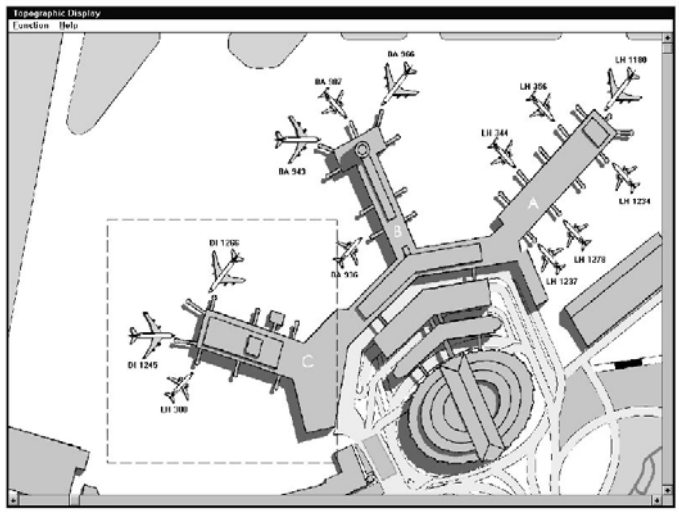

Fig. 3. Topographic Display [5]

expanded to include a scheduling component which allows every resource type to be redefined as a new resource. These scheduled resources are only acknowledged by the system within the Planning Mode and are only valid for the explicitly specified typical day. Such typical days, which contain the scheduled resources, cannot be copied into Operative Mode.

5. Conclusion

The airport infrastructure has a capacity limitation what is influenced by many factors. The goal must be to utilize all resources (check-in desks, departure lounges, gates, aircraft stands, baggage carousels, staff and equipments) to their maximal extent. This guarantees low unit costs and high profit potential. We have to know that air passengers cannot be serviced at an appropriate level and efficiently having no effective Resource Management System available.

Nevertheless, a Resource Management System will be continually developed with new modules based on the continuously arising needs of the airport and of course of the passengers.

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