Montreal International Airport: Simu
Storage System Impleme

Passenger Terminals

Overview

GSS Inc. is a Canadian engineering company that provides strategic and technical consulting services with a strong focus on simulation and optimization in the context of major infrastructure and transformation projects. GSS helps clients in different industries including healthcare, airports, transportation, logistics, and manufacturing. Their list of customers worldwide

growth of passenger traffic, and being a GSS customer for more than twelve years, Montreal International Airport invited GSS to assist in the design of an Early Bag Storage (EBS) system.

Later on, GSS and Montreal International Airport combined to work together on a Smart Baggage Handling System (BHS). To learn more about this, read the case study:

- Creating a Smart Baggage Handling System

Problem

In the last five years, Montreal Airport's passenger traffic has increased by 32% and is anticipated to continue growing at an average annual rate of over 4%. This has prompted the airport to launch many infrastructure projects to meet the anticipated growth in demand for support services. These support services include the baggage handling system (BHS), which is the focus of this study.

The BHS consists of several stages from passenger to plane. First, passengers leave their baggage at check-in or drop-off points. Conveyors then take the bags to an explosive detective system (EDS), and from there they continue to an outfeed and await loading. When a plane is ready for loading, its baggage is transferred from the outfeed to the plane on small cars called unit load devices (ULD).

Aircraft turnaround time and the overall capacity of the BHS at Montreal Airport was limited by the number of piers and carousels in the outfeeds. As such,

short term and the problem required an immediate remedy. Furthermore, airport management was planning to invest significantly in an early bag storage (EBS) system. The EBS would provide a centralized and automated storage system to hold passenger luggage until required.

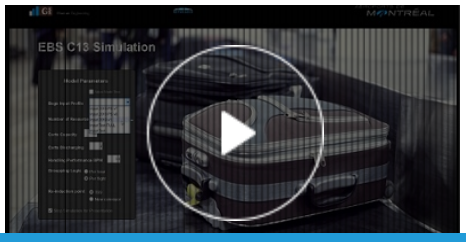
Airport management and GSS wanted to know if the EBS could be used as a buffer to smooth baggage flows and shorten the time piers were allocated to a flight. Doing so would improve aircraft turnaround time and shave peak demand. More efficient delivery of baggage to aircraft could reduce aircraft turnaround time and help accommodate more flights during peak times.

Simulation modeling was selected to identify the optimal EBS flight list. It would consider how to:

- Generate infrastructure savings.
- Minimize the impact of any changes on other operations.
- Maintain service levels.
- Optimize the EBS size.

Solution

The simulation model helped develop a schedule for all the airport's baggage handling, including:



- Which pier and how much pier time should be allocated for each flight.
- What baggage

Since this was a multi-criteria optimization problem with thousands of agents and factors, the engineers decided to create a digital twin. This would enable the analysis of operations and the testing of ideas without disrupting the airport's real baggage handling.

To begin, GSS specialists brought together all the relevant airport departments, airlines, and other concerned parties to understand their needs and begin the process of developing a LEAN design solution. They decided to begin by implementing a manual EBS (where employees handle the bags) for the first two years while the automated infrastructure was built.

There were three phases of model development:

1. Based on the analysis of the historical bag arrival profile per flight, a simulation model was developed to estimate the expected bag flow of the BHS. This model was also used to find the best combination of flight allocations and choose the candidate flights for peak-shaving. Different scenarios of flight lists were generated and then tested on the EBS to find the best configuration given the capacity and technical constraints.
2. Since the automated solution would take around two years to build, a temporary manual EBS solution was implemented where airport staff would manage the bags and put them into the carts. The second modeling phase simulated this manual operation, including the logistics and operational constraints of storing bags in temporary carts instead of an automated infrastructure. This model allowed airport managers to define the best

GSS chose the AnyLogic platform for the simulation and multi-criteria optimization because of its performance and ease of use when developing complex models. AnyLogic provides engineers with many built-in libraries. For this project, both the Process modeling library and the Material handling library made it significantly easier to model all the conveyors, piers, and carousels.

The flexibility of AnyLogic enabled high- and low-level decision support with one model as well as the integration of databases, Excel files, and external libraries – specifically, some scripts written in R that allowed the incorporation of the baggage arrival profile into the model.

AnyLogic also made process automation possible and provided the speed for engineers to run many optimization "what-if" scenarios with multiple influencing factors and KPIs.

Outcome

Montreal International Airport was equipped with a decision-support simulation tool that allowed it, and the airport's main stakeholders, to make better timely decisions and solutions.

Using the multi-phase approach, the airport managed to maintain its service levels throughout the transformation process and to meet the increased demand.

Importantly, the EBS operations, developed with the help of the model, helped the airport avoid numerous costs related to poor service quality. This was achieved

The project also produced cost savings by avoiding the need for an additional sorter with ten piers. Overall, these project-related savings have helped Montreal International Airport launch further infrastructure projects and continue the airport's development and expansion.

Watch the video of Alvaro Gil, M.Sc. Strategic Consultant at GSS, presenting this case study at The AnyLogic Conference, or download his presentation.

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