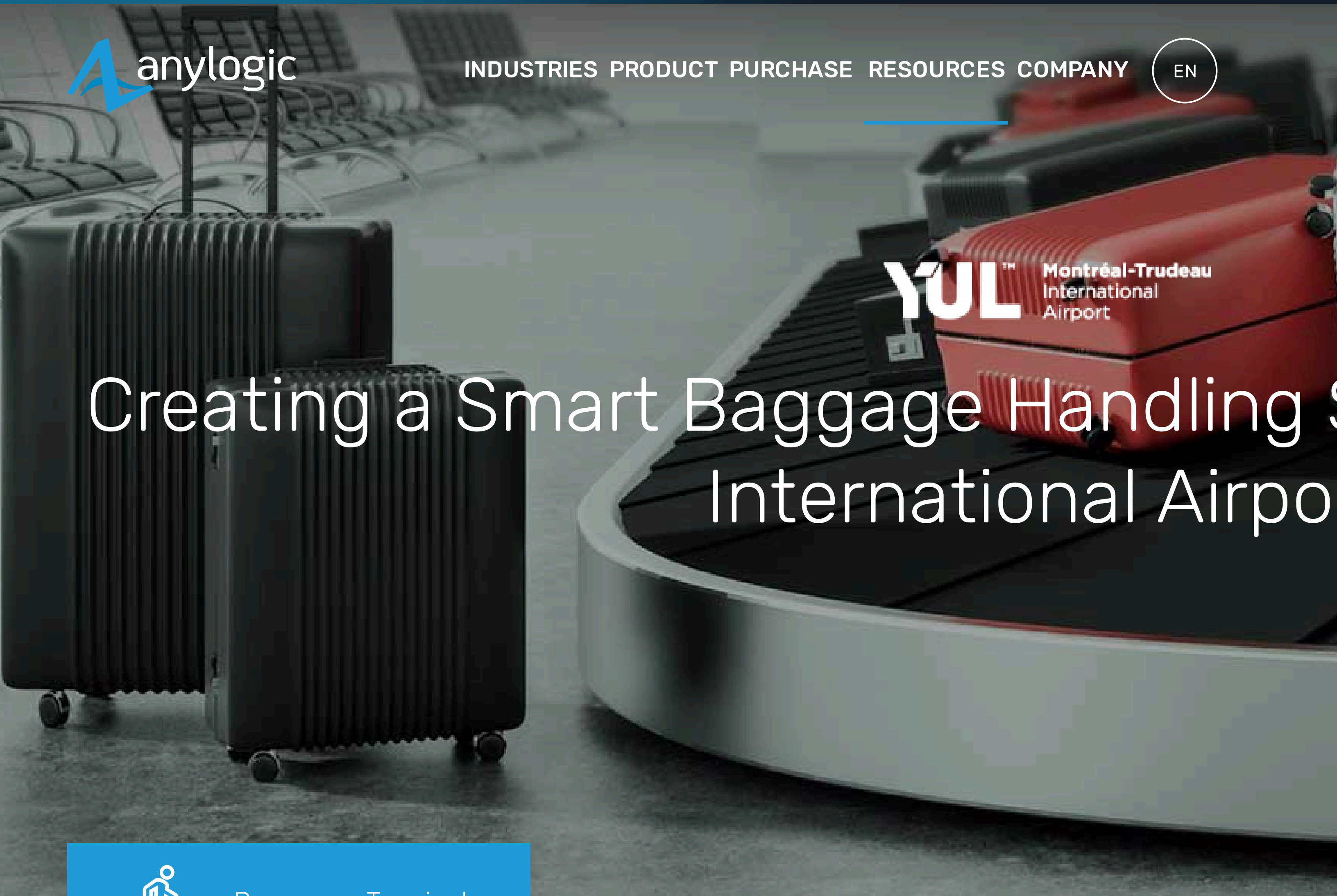


Creating a Smart Baggage Handling S International Airpo

Passenger Terminals

Overview

Montreal International Airport is one of the most important airports in North America. It ranks 11th in terms of total volume of passengers. 20.3 million passengers passed through this airport in 2019 (an increase of 38% from 2014-2019), traveling to 148 direct destinations, of which 89 were international.

Airports, Aerospace & Energy, Health and Life Sciences, and Supply Chain was tasked with modeling a Smart Baggage Handling System (BHS) to optimize the airport's future.

Previously, GSS and Montreal International Airport had worked together on an Early Bag Storage (EBS) system. To learn more about, this read the case study:

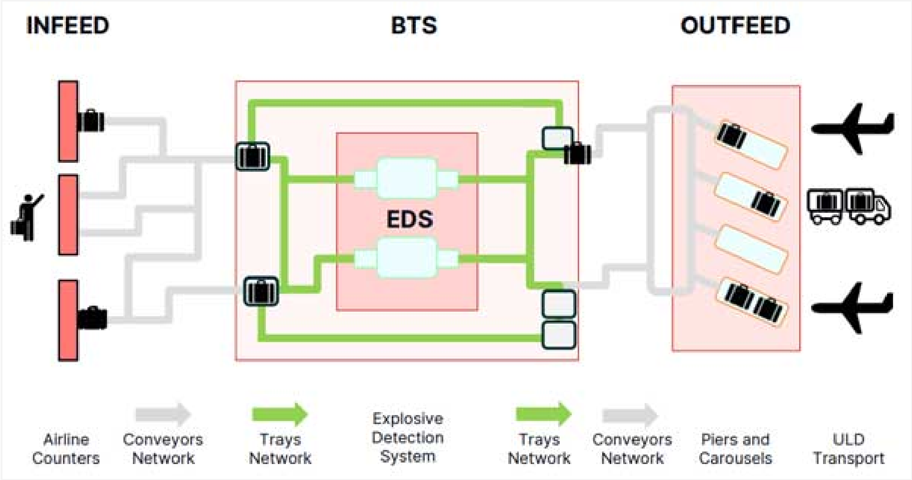
- Early Bag Storage Implementation

Problem

When a passenger arrives at the airport with their baggage, airports must be able to move these bags from the passenger at check-in to the end destination in the hold of the aircraft. To do this, a Baggage Handling System is required.

A BHS is a combination of conveyors, screening equipment, automation components and stations that all work together. The BHS transports and processes bags from entry points and on towards multiple destination piers.

It is a closed complex system with thousands of interconnected elements. The complexity is due to a combination of factors. Firstly, empty and loaded trays circulate on conveyors along with bags on belt conveyors. These then need to be synchronized in order to load the bags onto the trays as well as unloading the bags from the trays. Secondly, there are multiple entry and exit points. Finally, there is a high throughput capacity and a lot of variability. This variability may come from inside the system, such as service at counters, as well as practical capacity related to the screening and handling equipment not being used to its full potential.



Baggage Handling System showing the Infeed, the Baggage Tray System (BTS), the Explosive Detection System (EDS), and the Outfeed

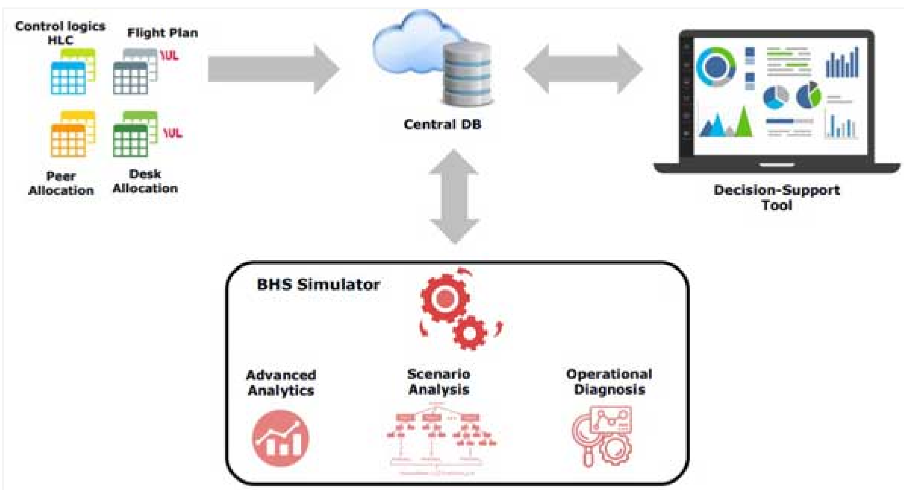
Solution

Traditionally, a BHS uses local variables, such as the number of trays and the number of bags in a segment, that manage the decisions. A High-Level Control (HLC) uses system thinking to take proactive and dynamic decisions based on multiple conditions. These can include elements such as a new destination for a tray based on new demand information, changes in the availability of trays in parking areas and reduced service modes.

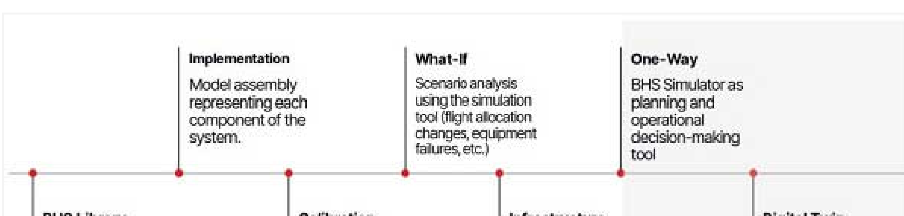
GSS tested thousands of **what-if scenarios** in order to design a robust logic, and to integrate lean and agile principles in the design process to simplify this logic.

AnyLogic was chosen to run this simulation because this HLC system required dynamic architecture and very flexible software. Millions of decisions needed to be taken during simulation runtime and managed by an agent-based approach. Combining flexibility, a robust system, and an agent-based approach, AnyLogic was the best choice.

To accurately represent operational reality, GSS designed BHS library components and used them in conjunction with elements from the AnyLogic Process Modeling Library and the AnyLogic Material Handling Library to perform the simulation. The integration with external data sources as TXT files, CSV, Excel and databases was additionally a very important criteria when choosing AnyLogic.



Simulation model architecture



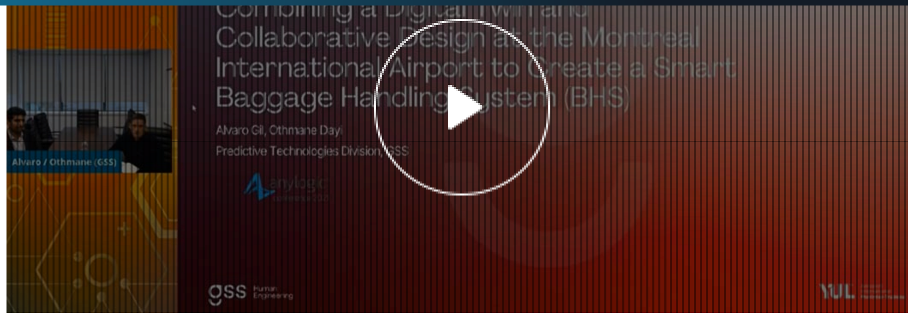
GSS successfully implemented a High-Level Control strategy along with the development of a stable and mature simulation platform with flexible architecture for the airport. As a result, a BHS was modeled with more than 1000 conveyors and more than 100 decision points, resulting in more than 2.8 million daily decisions.

The simulation platform brings added value as it will:

- Be used as a rapid decision-making tool for operations and planning.
- Support the identification and communication of bottleneck issues.
- Assist the infrastructure growth decision e.g., adding lines, equipment, etc.
- Increase service levels at the airport and with airlines, which leads to greater passenger satisfaction.
- Be used for contingency planning.
- Be able to demonstrate efficiency gains.

As a result of the development and long-term collaboration with all the stakeholders, the target practical capacity was reached on a consistent basis. The airport is now in a position to handle the recovery phases and return to consistent growth. In the future, digital twin will be consolidated for real-time support to operations. Digital twin in this case represents the two-way fluid communication between the simulator and the BHS.

The case study was presented by Alvaro Gil and Othmane Dayi PhD, of the Predictive Technologies



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