Optimizing Cargo Operations for Singapore Airport Terminal Services

Group Members: Ng Guo Jun, Ding Yi Xin , Kenny Kuek, Lim Wei Zi, Jordan Tan
Supervisors: Asst Prof Ng Tsan Sheng Adam, Assoc Prof Tang Loon Ching

Introduction

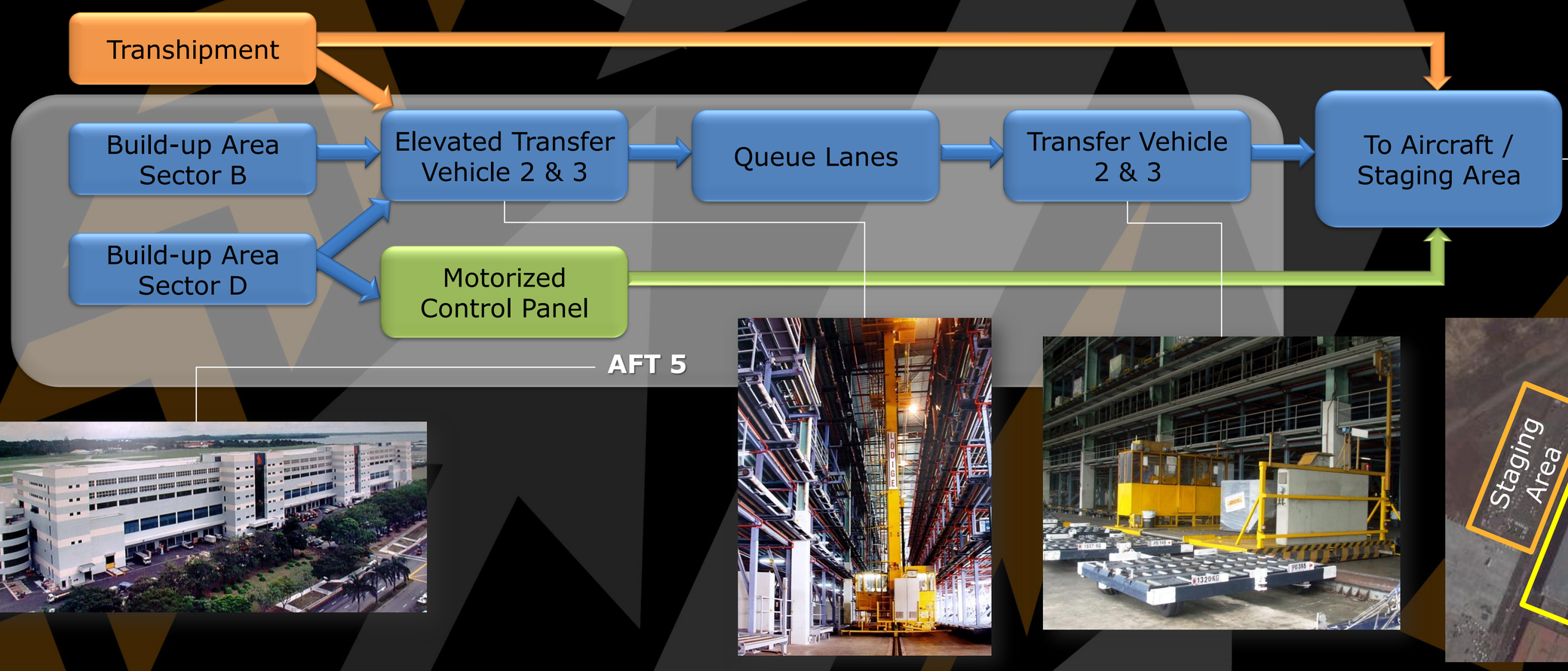
Singapore Airport Terminal Services (SATS) is the leading provider of integrated ground handling and airline catering services at Singapore Changi Airport. This project focused on the export handling processes at SATS Air Freight Terminal 5 (AFT 5).

Objective

To balance the entire export handling process and to achieve timely release of Unit Loading Devices (ULDs) such that the utilization rate of the Staging Area is at an optimum level.

Export Handling Process Map

•Export cargo is packed together at Build-up Areas (BUA) to form ULDs.
•ULDs from BUA Sector B and D are transferred by Elevated Transfer Vehicles (ETVs) into Queue Lanes.
•Transfer Vehicles (TVs) then release these ULDs onto Pallet Dollys (PDs), to be towed to the aircraft or Staging Area if the loading window is not open.
•ULDs from BUA Sector D can also be transferred by Motorized Control Panel (MCP) before being towed to the aircraft or Staging Area.
•Transhipment ULDs can enter AFT 5 to be processed similar to built-up ULDs or be towed directly to aircraft or Staging Area.

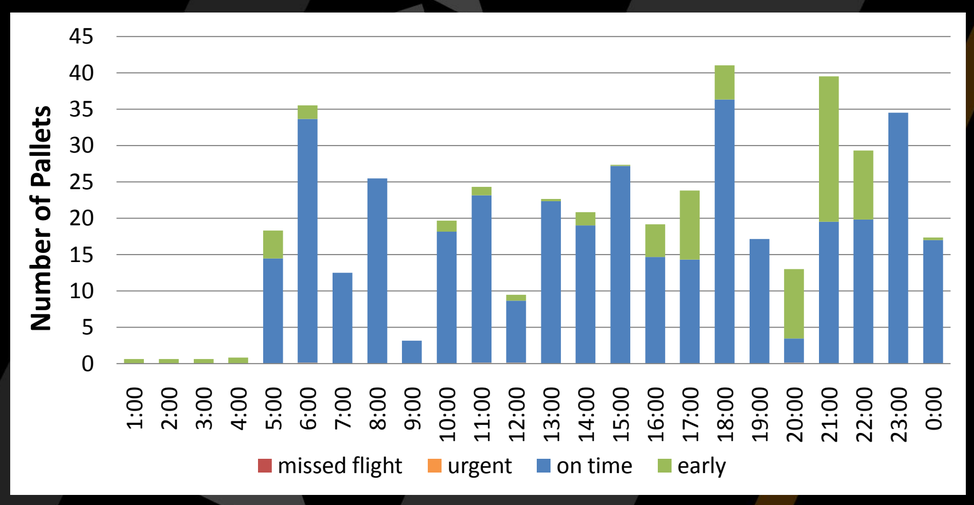


Methodology

•A mathematical programming model was developed to balance the export handling processes.
•Results obtained from this model were then generalized and verified using simulation.

a) Mathematical Programming Model

•Discrete time intervals of 15 minutes were used in this model.
•Capacity of ETVs, TVs, MCP and queue lanes were calculated based on past data and were used as resource constraints.
•Objective: Minimize total system cost (holding cost and late cost)
•The model was built and solved using ILOG OPL Development Studio.

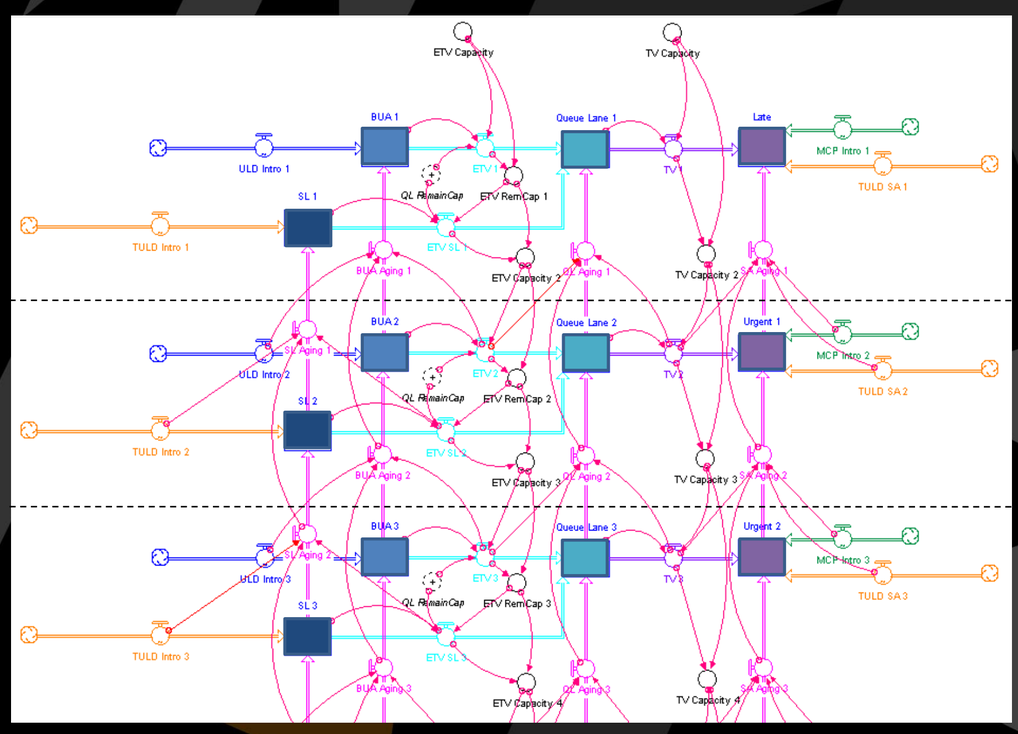


Timeliness of ULDs chart

•Most of the ULDs were released on time as opposed to the extreme cases of being released too early or too late for their flights.
•Results satisfied the constraints, and the system was still able to cope with the demand.
•The results were generalized into simple rules, so that SATS can implement them on the ground.

b) Simulation

•The generalized rules were verified using simulation.
•Using the iThink software, two versions of the simulation model were built.
  •Version 1: Model existing operating practices in SATS
  •Version 2: Simulate processes based on derived rules



iThink model (Version 2)

•The results from both versions were compared.
•The results showed improvements to the system when the derived rules were used.

Department of Industrial & Systems Engineering
Systems Design Project