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DISCRETE EVENT SIMULATION OF VIRGIN AUSTRALIA'S DOMESTIC AIRCRAFT GATES AT MEBOURNE AIRPORT

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1 INTRODUCTION

Virgin Australia is the second largest airline in Australia with over 350 flights per day and more than 17 million passengers per year. Virgin was the leader in on time performance (OTP) from July 2014 through June 2015 with and OTP of 87.9%, where a flight was classified as on time if it departed the gate within 15 minutes of the scheduled departure time. The majority of flights are flown by three types of aircraft: Boeing 737-800s, Embraer E-190s and Airbus A330-200s.

Melbourne Airport (MEL) is one of Virgin's largest hubs with about 100 Virgin flights per day. The majority of these flights go to gate at a terminal with ten gates dedicated for Virgin Australia's use, with four additional gates at an adjacent common user terminal available as required. Not all gates are configured the same. Only one gate at the dedicated Virgin terminal can handle an A330 without blocking any other gates, while a second A330 can be accommodated at the common user terminal. Nine of the ten gates at the Virgin terminal have an aerobridge, while one gate requires customers to access the aircraft via stairs.

In February 2015, Virgin Australia's OTP was higher than its main competitor at MEL by 0.2%.

2 PROBLEM DESCRIPTION

A new gate plan at MEL was being considered which decreased Virgin's utilization of the existing common user terminal and increased utilization of the dedicated Virgin terminal. While all scheduled aircraft arrivals and departures could be scheduled with the decreased gate capacity, there was some concern on potential impacts to OTP due to off schedule arrivals and departures and lack of flexibility to make changes during day of operations. In addition to OTP impacts, the potential negative guest experience due to increased aircraft queuing for gate on arrival and increased utilization of the gate without an aerobridge was of concern. There was also increased risk to any A330 arrivals due to the limited access to the A330 gate at the common user.

A decrease in OTP at MEL could propagate throughout the route network in Australia having significant knock-on impacts and influence overall OTP, risking Virgin Australia's market leader status. A decreased customer experience could influence customers willingness to fly with Virgin Australia.

In order to understand the impacts on OTP, arrival queuing, and A330 risks, a discrete event simulation of the Virgin Australia's operation at MEL was constructed in the Simio simulation software.

3 METHODOLOGY

The overriding objective of this study was to quantify the impacts on Virgin's performance at MEL due to the revised gate plan and, if necessary, create and test an alternate plan to mitigate any negative impacts while also increasing gate utilization. In order to realize these objectives, the following steps were taken:

- First, one year of historical data for Virgin's flights was analyzed in order to determine arrival variance distributions, as well as arrival and departure activity durations.
- Next, a high-level simulation model of the system was developed in the Simio software platform and was used to simulate one month of scheduled flights at MEL. This model did not include details of the system such as taxi-ways or gate constraints by aircraft type. This model was validated and then the new gate scenario was compared against the current operation.
- A more detailed simulation model of the system was developed that incorporated individual gate and taxi-way resources and rules. This model was run for 260 replications with each replication being approximately one month of time.
- Potential alternate gate availability scenarios were identified and tested. Each scenario was evaluated based on the negative performance impact compared to the status quo.

A picture of the simulation model is shown in Figure 1.

Figure 1 Simulation Model of Virgin Australia's Operation at Melbourne Airport

4 KEY FINDINGS AND RECOMMENDATIONS

The model identified not only the negative impact on OTP due to the new gate schedule, but also quantified by time of day the increase in arrival queuing. In addition, management gained a better understanding of the key driver of gate capacity – aircraft time at gate as opposed to the previously believed number of flights per day.

Using the analysis, changes to the gate availability schedule were made and tested in the model. A final scenario that mitigated the negative impacts while still increasing overall gate utilization was recommended and adopted by the business.

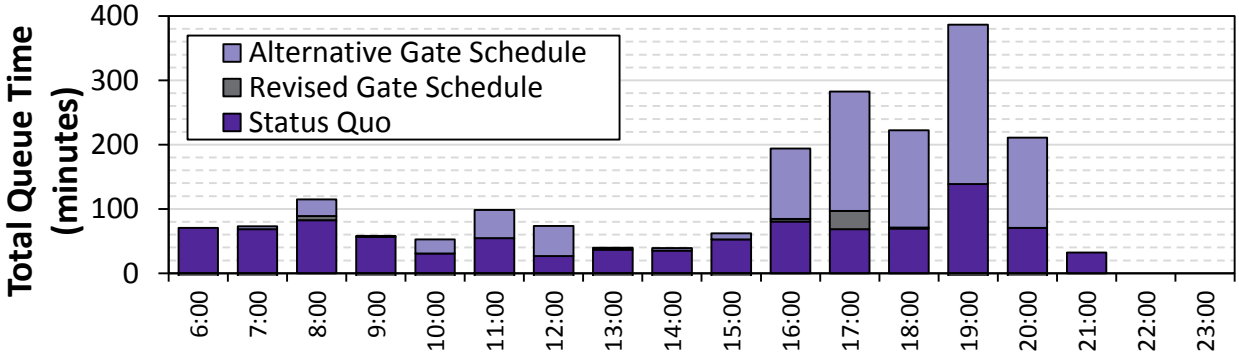

Figure 2 Sample Arrival Queue Results