Analysis of Congestion of Taxiing Aircraft at a Large Airport

In large airports, a large number of aircraft are taking off and landing daily. Congestion during aircraft taxiing (going from terminal to runway) can still occur and is affected by several factors such as the concentration of aircraft and weather. (Fig. 1) Therefore, it is essential to clarify the causes of congestion and to propose a plan of action to ease congestion. Taxiing aircraft at Tokyo International Airport (Haneda)(Fig. 2) are simulated and analyzed by using actual data for taxiing and operations.

Various parameters necessary for the operation modeling of aircraft are acquired. The time and speed of aircraft taxiing were measured. For a departing aircraft, it moves from spot, to taxiway and finally to runway. Since aircraft cannot move in reverse, pushback is carried out to push it backwards using a pushback truck. The pushback time are measured with a stopwatch. Arrivals are given priority over departures when using the taxiway and pushback lanes. These parameters are used for simulations of aircraft movement. The service diagram on May 10, 2010 is used. The situation of Tokyo International Airport in a simulation at about 8:30 a.m. is shown in Fig.3.

The arrival rate at the runway is constantly distributed so that the average queuing time is the shortest. The service diagram of the departure aircraft is changed so that the interval of the departures in the service diagram can be steady in Strategy 1. The departure time of each aircraft is changed to 218 seconds on the average, and it changes to a maximum of 884 seconds. The service diagram is not changed but the timing of departures is adjusted and changed in Strategy 2. By monitoring the real-time situation of the arriving aircraft as well as the departing aircraft, the adjustment in the departure order and take off order can be conducted similarly in real time.About 43% was reduced, and congestion was reduced with regard to the maximum taxiing time in Strategy 1. In addition, the average taxiing time was reduced significantly, by about 28%. In Strategy 2, the maximum taxiing time was reduced to at least 10%.

Fig.1 Congestion at around 8:00 a.m. (five aircrafts are queuing up).
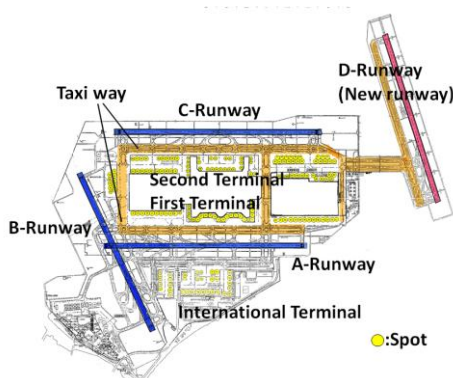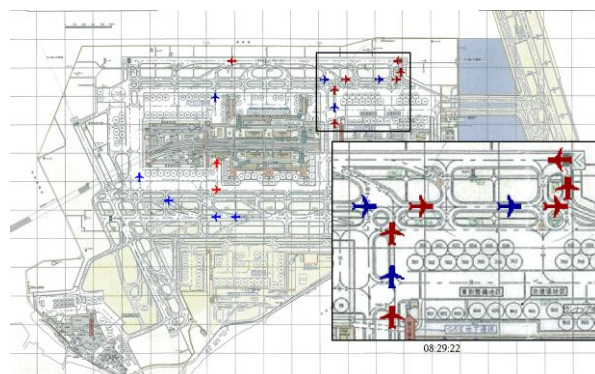

Fig.2 Building layout of Haneda Airport

Fig.3 Simulation of aircraft taxiing at approximately 8:30 a.m.