

## Optimization of Scheduling Problems on Runways

### 1. Purpose

Currently, aircraft delays at airports are eliminated primarily through management by the control tower. Moreover, the Fukuoka Airport is designated as a "congested airport" where air demand greatly exceeds the airport facility capacity. Flight delays are especially chronic during the peak morning and evening hours.

In this paper, we express the creation of the take-off and landing schedules for multiple aircraft at the Fukuoka Airport using mathematical formulas. We developed an algorithm that mechanically resolves delays that occur owing to various reasons, such as weather conditions or delays in the arrival of the next aircraft to be used. In addition, a systematic aircraft arrival order is considered to reduce airline and passenger frustrations (We call this condition (1)). We plan to allow the two aircraft of All Nippon Airways Co., Ltd. and Japan Airlines Co., Ltd. to alternately use the runway as much as possible.

### 2. Method

First, we investigated the current usage of each aircraft and usage conditions at the Fukuoka Airport. Based on this information, the problem of minimizing the scheduled flight time delays of each aircraft, when delays occur, was expressed in mathematical formulas using a method called mixed integer programming, while considering various physical constraints. Furthermore, we expressed the equality in aircraft order using a mathematical formula. The formulas created were calculated numerically using the program. Based on the output results, the timetable was corrected to manage delays.

### 3. Results

By taking the above constraints into account, we were able to calculate a new timetable that improved upon the existing timetable at Fukuoka Airport. When focusing on the 30-minute timetable, the order of the aircraft, without the constraint condition (1), there was an inequity of about 10 minutes.

However, with the new timetable with the constraint condition (1) added, the unfairness of the order of aircraft was eliminated.