Abstract

Most commercial airlines operate on a hub-and-spoke network which means that a small disturbance can have a significant impact on their planned operations. These disruptions can be caused by cancelled or delayed flights, unavailable aircraft or crew, or reductions in airport capacity. When such disruptions occur, airlines must plan recovery operations so as to return to normal operations as soon as possible. Airline recovery problems are usually solved in a sequential manner with the aircraft recovery problem solved first, followed by the crew recovery problem and finally the passenger recovery problem. However, this can lead to suboptimal solutions. Solving the integrated recovery problem can yield substantial gains for the airlines. In this thesis we present different heuristics developed to solve the integrated aircraft and passenger recovery problem as described in the ROADEF 2009 challenge.

The first solution method presented is a large neighbourhood search heuristic (LNS) which alternates between three phases: construction, repair and improvement. Numerous refinements have been introduced so as to explore more thoroughly the solution space. The heuristic was tested on the ROADEF 2009 challenge instances and the best known solutions were found for 21 out of the 22 instances.

The second solution method presented is a column generation post-optimization heuristic. The aircraft and passenger recovery problem is modeled as a mixed integer program and different operations are performed so as to reduce the size of the model. The model and the heuristic can also be modified in order to solve the larger instances. The resulting heuristic improved significantly the best known solutions for 18 out of the 22 instances from the ROADEF 2009 challenge.

keywords: passenger recovery, aircraft recovery, integrated recovery, large neighbourhood search, column generation