TEACHING NOTE
Managing Operations in the Time-Shared Jet Business

Synopsis

Time-sharing of corporate jets is a new and rapidly growing service business. It offers customers the convenience and the advantages of a private jet, without the high cost of ownership and the responsibilities and expenses associated with maintenance, storage and operations. A company operating these jets takes the responsibility of making a jet available on time, whenever and wherever a customer needs it. To provide customers with such high service levels and to be profitable at the same time, the company needs to make the right decisions and execute them effectively both at strategic and operational levels.

The important decisions for time-shared jet companies include deciding on the size and the mix of the fleet and the crew, and routing/scheduling of the jets to meet the service requirements while minimizing costs. This case focuses mainly on the day-to-day operational activity of routing/scheduling and briefly touches upon the strategic decisions on fleet and crew size and mix.

Objectives

The case introduces a new service business, which was first pioneered about a decade ago and has been growing rapidly since then. It begins by providing an overview of the business environment, discusses the factors which lead to the initiation and the growth of fractional jet ownership programs, and gives a summary of the major players in the market. It then explains the service requirements in the operation of time-shared jets, the constraints and the business objectives. Students will learn to identify "problems" in a real-life business situation, to model them, and to solve them either by using standard techniques or by developing new solution methods. In particular, students will learn to model a complex problem as a linear/integer program, to identify the type of data needed in decision making, to use a commercial package for modeling and solving linear/integer programs, to identify special cases of complex problems which might be easier to solve, and to develop heuristic solution methods for complex problems, possibly utilizing the solution approaches for special cases.

Assignment Questions

Questions are included in the main body of the case. In addition to the given questions, the case can be expanded by including additional questions on fleet size and mix determination, crew off-day assignmets, crew scheduling and other issues that relate to the operations.

Analysis

Case analysis is presented in detail in a separate document. We first give a brief introduction to the application, discuss some of the major operational problems that need to be addressed and give an overview of the related literature. We then explain the routing/scheduling problem of time-shared jets in detail, discussing main objectives and constraints. We follow with a discussion on the complexity of the problem and present some special cases, which

are solvable using polynomial time algorithms. For the general problem we introduce a linear/integer programming formulation. We then present a 4-step "construction" heuristic (and its three different variations), which generates a feasible solution from scratch and an "improvement" heuristic, which takes a feasible solution as input and tries to improve it by local exchanges. Finally, we present computational results that compare the perormance and the running time of the integer programming approach with the heuristic. The analysis also contains an example, which illustrates in detail problem objectives and constraints, the formulation and the heuristic.

Computer Teaching Files

The following computer programs (in C) are available upon request:

1. *geninput*: This program generates random test problems. It takes as arguments a filename (into which it writes the randomly generated data), number of cities (possible departure locations and destination), range1 (time window for flight time between any pair of cities), range2 (time window for total travel time for any trip), number of aircraft, number of trips, length of the scheduling horizon, percentage of trips that are pre-scheduled and a seed for random number generator. It creates a formatted file that contains the data for the randomly generated test problem.

2. *genlp*: This program takes as input a data file and creates a linear/integer program that models the aircraft scheduling problem. It writes the integer program into a new file, in a format specified by CPLEX.

3. *heur*: This program is a heuristic (discussed in detail in the analysis document) that solves the aircraft scheduling problem. It calls a number of other C programs as subroutines.