

Restructuring the Revenue Management System of North Star Airlines

North Star Airlines is a medium-sized airline company serving eight major cities in the United States. Since it was established in 1993, North Star Airlines has been focusing on the price-insensitive business segment of the passenger market to provide high-cost service. As a company tradition, it has adopted the policy of offering one price for each origin-destination pair, and partly due to this policy, North Star Airlines has been able to use simple revenue management methods to maximize the revenue from its flights.

Problem Definition

Times have changed for North Star Airlines. The new CEO, David Fox, has been noticing that the price-insensitive business segment of the market is not enough to fill the flights operated by North Star Airlines. After some analysis on the costs and the benefits, he finally made up his mind that North Star Airlines should also start providing low-cost service to take advantage of the price-sensitive leisure segment of the passenger market. This issue was discussed in the board meeting held on October 29, 2005 and it was decided that North Star Airlines should offer two prices for each origin-destination pair – one for the price-sensitive leisure customers who tend to book early and one for the price-insensitive business customers who tend to book at the last minute. The new pricing policy has been in effect since January 1, 2006.

Due to this pricing policy change, most of the revenue management models used by North Star Airlines are now obsolete. The Manager of Revenue Management Operations, Ron Gilbert, decided that it is best to leave the restructuring of the revenue management system to a professional consulting team. He has also been thinking that the current overbooking models of North Star Airlines are not doing a very job and the restructuring of the revenue management system might be a good opportunity to get some outside opinion about this problem. Mr. Gilbert contacted your team to restructure the entire revenue management system.

North Star Airlines Network and Data

On a daily basis, North Star Airlines operates the network of flights shown in Figure 1. New York and San Francisco are the two hubs, whereas the other six cities are the spokes served through the two hubs. An itinerary from any origin to any destination in the network is possible. However, an itinerary from a spoke to another spoke has to be routed through at least one of the two hubs. For example, an Austin-Seattle itinerary has to be routed through San Francisco, whereas an Austin-Miami itinerary has to be routed through San Francisco and New York.

Mr. Gilbert provided your team full access to the reservation system and you were able to obtain data on the timings of the reservations for the flights departed between July 1, 2006 and August 31, 2006. Each file that accompanies the project description includes the timing of the reservations for the flights departed on a particular day. For example, the file named 20060701.txt includes the timing of the reservations for the flights departed on July 01, 2006. The structure of each file is as follows.

Date – This column indicates the date at which the reservation is made.

Origin-destination – This column indicates the origin-destination pair for which the reservation is made.

Class – This column indicates the fare class for which the reservation is made. There are two fare classes.

Conversations with Mr. Gilbert revealed that North Star Airlines starts accepting reservations for a flight 30 days in advance. The number of requests for different itineraries on each day is relatively stationary during the first half of the 30-day period. Majority of the customers during the first 15 days or so belong to the low-cost segment of the market. On the other hand, the situation is reversed during the second half of the 30-day period. Majority of the customers during the second 15 days or so belong to the business segment of the market. The reservation system only shows the reservations, but some of these

reservations are canceled before the flights depart. There is no data on cancellations, but Mr. Gilbert believes that about 2.5% of the on-hand reservations call in to cancel *each day*. North Star Airlines used Poisson processes to model the arrivals of itinerary requests in the past and they seemed to provide adequate fit.

The fares for the itineraries and the capacities for the flights have already been set by the North Star Airlines Revenue Management Group. The accompanying spreadsheet summarizes these data. Upon cancellation, the low-fare tickets are 50% refundable and the high-fare tickets are 95% refundable. It is estimated that if a reservation cannot be honored at the time of the departure and has to be bumped to a flight run by another airline network, then the cost incurred by North Star Airlines is twice the fare paid for the reservation.

Performance Measures and Objective

The Revenue Management Group is evaluated based on the revenue that North Star Airlines makes on the flights that it operates. Therefore, Mr. Gilbert specifically asked you to concentrate on the revenue. At the same time, conversations with Mr. Gilbert revealed that he would be happy to see if your team can come up with adjustments to the basic revenue metric that would be meaningful from the perspective of measuring the effectiveness of the revenue management system. Another concern is the number of passengers that need to be bumped to a flight run by another airline network. North Star Airlines wants to keep this number at a reasonable level to obey the regulations of the Federal Aviation Administration.

Mr. Gilbert is also interested in increasing the market share through price discounts. Little data is available on how the customers would react to price discounts, but Mr. Gilbert is certain that the business segment is price-insensitive. Therefore, an important question that your team is asked to investigate is whether providing price discounts to the low-cost leisure segment is a preferable option. It is not clear how the leisure segment responds to the price discounts and some sensitivity analysis is needed to answer this question.

Deliverables

Your project report should be made up of the main report for Mr. Fox and Mr. Gilbert, and technical appendices to allow the Revenue Management Group to repeat your analysis. The main part of the report is for non-technical people who know the airline industry well and have a broad understanding of revenue management concepts. You can certainly discuss protection levels, bid-prices and overbooking pads in the main part of your report.

The ideal length for your project report is 15-18 pages (excluding appendices). Below is a suggested outline. You do not have to follow the exact outline (apart from the executive summary), but you should be sure to include at least this much information.

Executive summary – This is the only part of your report that many high-level managers will read. Give a synopsis of what you were asked to do, what you did and what you discovered. Do not just outline what is in the report. Think what you would want to know if you were a high-level manager, and this was all that you read. This section should be at most one page.

Data analysis – The North Star Airline executives usually have an idea about the general demand metrics and the results of your data analysis help the reader to build confidence in your model.

Modeling approach and assumptions – Give the details of your modeling methodology. For example, did you use a protection level-based or bid-priced-based model? How did you handle cancellations?

Model verification and validation – Convince the executives that your model is a good one. It would be interesting if you had access to the current revenue management system so that you could compare the performance of your model with that of the current revenue management system. However, given that this

is not possible, you need to be creative to prove that your model indeed performs well. It is very important to prove that your model performs well.

Results – Use your model to answer the questions that the North Star Airlines executives are interested in. Remember you are not doing a homework assignment. Make sure that your project report is not a list of mechanical answers to the questions that Mr. Gilbert is interested in. Think about sensitivity analysis. Use charts, tables and figures to make your point. Remember that Mr. Gilbert would be happy to see the answers to some of the questions that he forgot to ask.

Conclusions – State the conclusions that you derive from your study.

Appendix – Give the details of your data analysis and mathematical model. You should include enough detail so that the Revenue Management Group can build your model from scratch.

Your report is due by November 29, 2006 at 5:00 pm, in the drop-box located on the second floor of Rhodes Hall. You will not be able to use your grace days for the project. A penalty of 50% per day will be applied on late projects. Be sure to give the name of all team members on the title page or equivalent. Remember that this is the last week of classes, so you will be busy with other work. Every member of your team has to be involved in the modeling building and programming effort.

Suggestions

- As of November 1, 2006, we are still to cover some revenue management approaches in class that you can use to build a model for North Star Airlines. However, make sure you start analyzing the data early so that you have an estimate for the number of requests for each itinerary on each day. Come up with a reasonable cancellation model. Investigate how the arrival processes for the low-cost and business customers change over time. This will ensure that the input to your model will be waiting. The project is an exercise in analyzing large amounts of data, as much as an exercise in building revenue management models.
- Here is a simple model that you can immediately use. Adjust the capacity on each flight leg by using the cancellation probability. That is, use the deterministic overbooking policy that Paat showed in class to assume that the capacity on each flight leg is $c_i / (1 - \text{probability of cancellation})$, where c_i is the physical capacity on flight leg i . In this case, you can use a network revenue management model with no cancellations and with capacities $c_i / (1 - \text{probability of cancellation})$. This is just to show you how creative you can get, but there are no guarantees on the performance of this model.
- Be creative and go beyond what Mr. Gilbert is asking. As mentioned above, Mr. Gilbert would be happy to see the answers to some of the questions that he forgot to ask. Think about other performance measures that Mr. Fox would be interested in.
- You do not have to build the most complicated model. Simple is fine, as long as it works well. Building a simple model which is easy to evaluate and test is much better than building a complicated model which is impossible to evaluate or test. Convincing the North Star Airlines executives that your model performs well is extremely important.
- Make reasonable assumptions, as long as you can convince the executives that these assumptions do not invalidate your model.

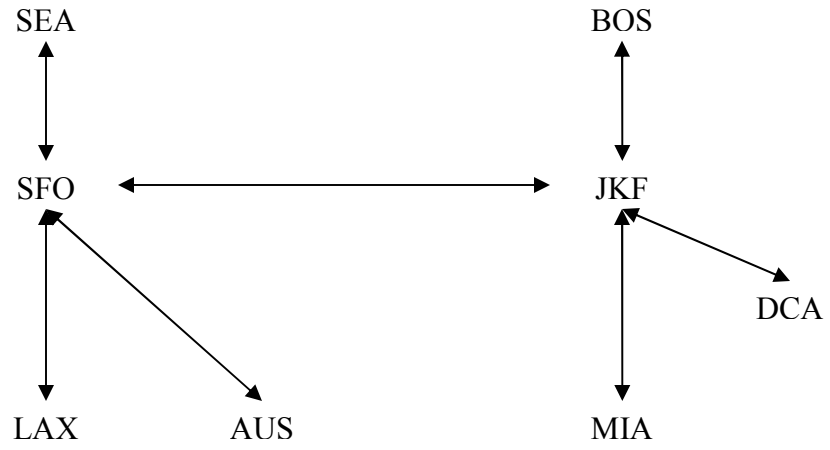


Figure 1: Network of flights operated by North Star Airlines.

Project Team Evaluation

Please email this form to one of the teaching assistants immediately after you turn in your project.

Rate all of your team members on a scale from 0 to 10. A score of 10 means that the person contributed reasonably to the team effort. A score of 0 means that the person contributed nothing. Please also rate yourself. If you do not give a score of 10 to every member of your team, then shortly justify your assessment. In the last portion of the page, describe how you contributed to the project and what portion of the model you coded up. You can be absolutely sure that your evaluations will remain confidential. Your project will not be graded unless we receive an evaluation form from every member of your team.

Name	Score
(Yourself)	

Justification

(You can use another page if you need to.)

Work You Did

(You can use another page if you need to.)