

Air Transportation Systems Field Exam: Airport Systems January 2013

Note: You have 60 minutes to prepare for this examination. The preparation is closed book, but you can bring any notes that you generate during the preparation period to use in the oral exam. The oral examination will be 45 minutes long.

Make any assumptions that you believe are reasonable, but be sure to state them while answering the questions.

GOOD LUCK!

1. Consider a flight scheduled to depart a major network airline hub's (HUB) connecting bank at 1400 and to arrive at a spoke city (SPK) at 1700. The same Airbus 320 aircraft and crew are then scheduled to depart SPK at 1745 and arrive back at HUB in time for a connecting bank at 2030.
 - A. On a particular day, the arrival of the HUB-SPK flight is delayed by 60 minutes due to weather issues and resulting congestion at SPK. Focusing only on this one flight departure, discuss the operational implications and incremental costs to the airline of this flight delay. Be specific about the categories of airline operating costs that can be affected by such a single flight delay, and how they might be affected. To what extent does it make a difference whether this 60-minute delay is incurred (i) at the departure gate; (ii) while taxiing at the departure (hub) airport; or (iii) while airborne en route to the spoke airport?
 - B. Performance data for a month of operations of this HUB-SPK-HUB flight turn reveal that the HUB-SPK flight was delayed 78% of the time with an average arrival delay of 36 minutes. The return spoke-hub flight was delayed 84% of the time with an average arrival delay at the hub of 42 minutes. In the specific context of this flight turn, discuss the schedule changes (shifts in the timing of one or both departures only) that the airline could consider in an effort to reduce the impacts on its operations of persistent flight delays due to congestion at the spoke airport. What are the trade-offs (both economic and operational) involved in implementing such strategies?
 - C. Assume that a form of slot control is implemented at the spoke airport, such that the airline is no longer able to operate this particular flight turn from its hub. In response, the airline eliminates this flight turn from its schedule, and doubles the aircraft capacity on an earlier flight departing the hub at 1200 and departing the spoke at 1545. Describe briefly the expected impacts on the airline's traffic, yield and total revenues on its HUB-SPK-HUB operations.

2. Let us consider an airport with an arrival capacity of 60 aircraft/hour and an arrival demand of 40 aircraft/hour.
 - A. Suppose the arrivals are timed (through metering, for example) to arrive exactly 90 seconds apart, and the airport can land one flight a minute (exactly). What would the expected delay per aircraft be?
 - B. We know that in reality, aircraft will not arrive exactly as scheduled.
 - a. Could you describe a few of the reasons why this may happen?
 - b. Intuitively, would you expect the delay to increase, decrease or remain the same, when compared to Part (A)? Why?
 - C. Suppose the weather forecast predicts that the arrival capacity will be reduced to 45 aircraft/hour.
 - a. If the arrival demand remains unchanged, what will be the effect on the expected arrival delay and size of the arrival queue?
 - b. With arrival demand still at 40 per hour, suppose, instead, that due to weather uncertainty, we obtain a probabilistic forecast with two capacity scenarios: the arrival capacity is predicted to either be reduced to 45 aircraft/hour with probability $2/3$, or to remain unchanged (i.e., 60 aircraft/hour) with probability $1/3$. How would you go about estimating the effect on the expected arrival delays?
 - c. How do you think the system will respond to such reduced capacity?