

Assignment 3: Air Transportation Systems Analysis

Solution

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Problem 1

An airline is evaluating two aircraft to operate flights from . The following table shows two two aircraft proposed by airline executives to operate from La Guardia airport (LGA). The critical stage lengths the airline would like to fly with the selected aircraft are: a) LGA-DEN and b) LGA-IAH.

Table 1. Aircraft Considered in the Airline Evaluation.

Aircraft Considered
Boeing 737-500 with CFM56-3B-1 engines at 18,500 lb. sea level static thrust) engines. Aircraft maximum design taxi weight is 134,000 lb. with 122 seats in a one-class layout.
Boeing 737-600 (no winglets) powered by two CFM56-7B22 engines at 22,000 lb. sea level static thrust). Aircraft maximum design taxi weight is 144,000 lb. The aircraft has 150 seats in a one-class layout.

The airline would like to request your services to help them select among the two aircraft to start operations from LGA. The design airport temperature used should be the average of the maximum temperatures of the hottest month of the year. You can query these averages for any airport at:

<http://www.weather.com/weather/wxclimatology/monthly/graph/LGA:9>

More detailed information about the airport can be found at the AIRNAV database available on the web at: <http://www.airnav.com/airports/> or visit the airport site.

In your analysis use the latest version of the Boeing documents for airport design (http://128.173.204.63/courses/cee5614/sites_ce_5614.html#Aircraft_Data).

- a) Find the average stage length to be flown between each one of the critical OD airport pairs. In your analysis use the Great Circle Flight Path mapper link provided in our interesting web sites. Add 6% to the distances calculated to account for real Air Traffic route conditions and to account for possible weather deviations from the optimal Great Circle flight path.

For Boeing 737-500 the critical runway length is 6,700 feet (adjusted for gradient) for the LGA-DEN route.

For Boeing 737-600 the critical runway length is 5,100 feet (adjusted for gradient) for the LGA-DEN route.

- b) Find the runway length needed for each one of the aircraft operating the two routes. Determine if LGA has enough runway length to support these flights in the critical day (i.e., average maximum temperature of the hottest month of the year).

LGA has runways 7,000 feet long. The airport can support operations using B735 and B736.

- c) Estimate the average fuel per passenger assuming a load factor of 0.85 (85% of the seats used) for both routes.

The Boeing 737-500 is a lot less fuel efficient than the Boeing 737-600. The average consumption for the Boeing 737-500 is ~98 kg/passenger (216 lb/passenger). The fuel burn per passenger for the Boeing 737-600 is only 71 kg/passenger (156 lb/passenger).

d) Considering various factors which aircraft is the best for this airline? Explain.

Boeing 737-600 is newer and more fuel efficient.

Problem 2

a) A Latin American airline is evaluating purchasing three Boeing 777 aircraft to operate long-range passenger services between: a) Mexico City (ICAO code MMMX or IATA code MEX) and European and South American cities. Mexico City is located on a high plateau at 7,321 feet above mean sea level conditions. The city pairs to be operated have a minimum stage length of 3,800 nm and a maximum of 6,050 nm. The airline requires a minimum of 250 seats in a three class cabin layout. Boeing is offering both the Boeing 777-200LR and the Boeing 777-300ER to the airline. The airline would like to carry an extra 10 metric tons of freight under the fuselage to generate additional revenue in the long routes. In your analysis, use the great circle mapper application and add 6% to the route distance to account for Air Traffic and weather detours. Also consider the runway length available at MMMX.

Analysis:

The Boeing 777-300ER carries more freight and passengers than the Boeing 777-200LR while operating from sea level conditions. Both aircraft can serve markets out of Mexico City with restrictions (takeoff mass restrictions). The Boeing 777-200LR has a better payload range diagram than the Boeing 777-300ER for long flights with fewer restrictions.

For 250 passengers and 10 tons of freight the Boeing 777-200LR is a good choice because it has better performance from hot-high airfield operations (the case of Mexico City).