Exam 2 - Take Home

Open Notes and Internet

Instructor: A.A. Trani

Due: December 2, 2024 at midnight

Instructions

Create a solution file using the word processor of your choice. Convert to PDF and submit to Canvas.

Include all screen captures of all your work, including aircraft manufacturer's tables and figures used, FAA tables used, and others. You will be penalized if you do not include the graphics of the information used to answer the question.

Honor Code Pledge

The information provided in this exam is my own work. I have not received information from another person while doing this exam.

_____ (your signature/name)

Problem 1 (30 Points)

Answer the following questions briefly.

a) For Boston Logan International Airport (BOS), find the azimuth range (i.e., ten degrees of azimuth) with the most predominant wind direction. Please justify your answer by showing me the Iowa State Mesonet model wind rose. Use 30 years of wind data.

b) Are the runways at BOS oriented correctly? Comment.

c) Can Fort Lauderdale International Airport do simultaneous independent approaches in bad weather conditions? Comment on the FAA rule used.

d) During heavy wind from the West, George Bush Intercontinental Airport (IAH) operates arrivals on runway 26R and departures on runway 33R. Is the configuration subject to Converging Runway Operations (CRO)? Explain the reason for your answer.

e) Find the maximum takeoff weight possible for an Airbus A350-1000 (see Figure 1) using the longest runway at IAH. Assume ISA + 15 deg—Centigrade operating conditions.

f) How far can the Airbus A350 fly with 366 passengers (no extra cargo) based on the findings of part (e)?

Figure 1. Airbus A350-1000 landing at San Diego International Airport (A. Trani).

Problem 2 (40 Points)

This problem analyzes the runway capacity for an airport with the runway configuration shown in Figure 2. The airport fleet mix is shown in Table 1. Runway 4L is used for departures, while runway 4R is exclusively for arrivals.

For this analysis, we use the following technical parameters: a) in-trail delivery error of 20 seconds under IMC conditions, b) probability of violation is 5%. Arriving aircraft are "vectored" by ATC to intercept the extended centerline of runway 4R at a fix (point in space) located 13 miles from the runway threshold. Use the In-Trail Arrival-Arrival Separation Rules consistent with the Consolidated Wake Turbulence groups provided in class (i.e., FAA Order JO 7110.126B) to solve the problem. The departure-departure separation is consistent with the values on page 38 of the runway capacity handout (taken from FAA JO 7110.126B). Use 10 seconds for departure-departure buffers to model pilot reaction time and jet engine mechanical lags.

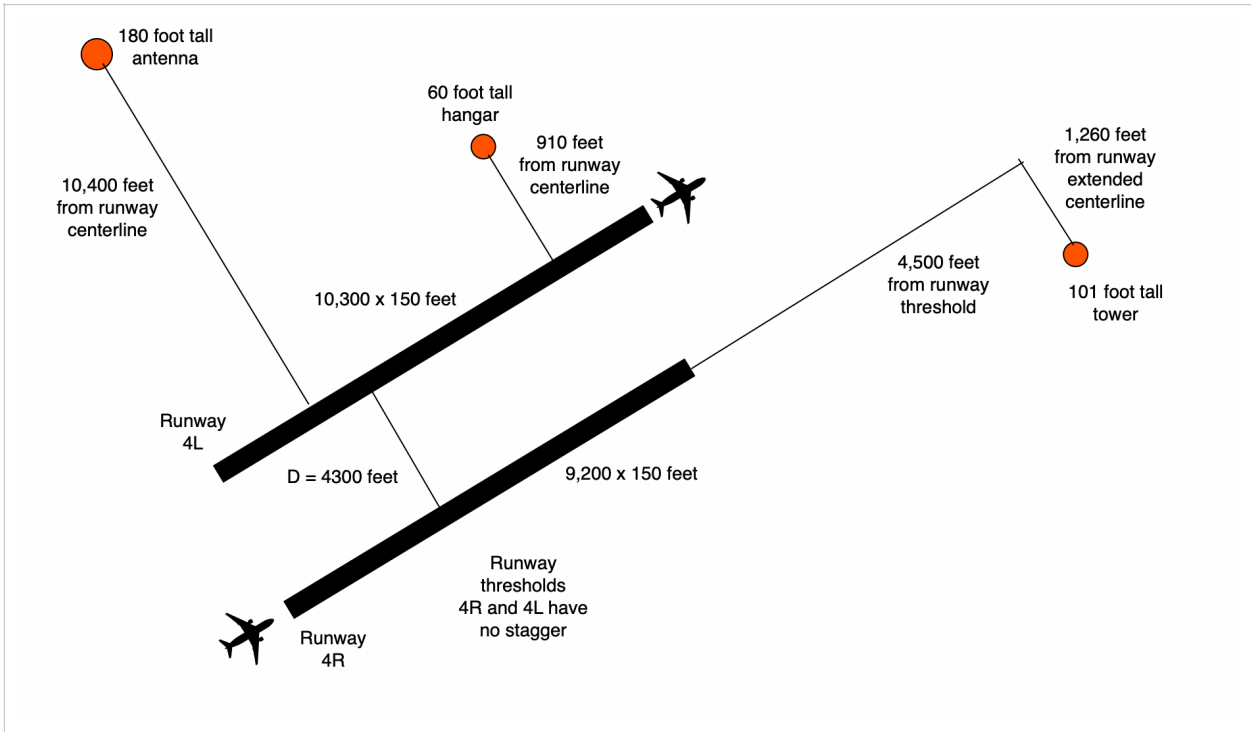

Figure 2. Runway Configuration for Problem 2. Both Runways are Precision Runways. Object Heights are Above Ground Level.

Table 1. Runway Operational Parameters and Fleet Mix for Problem 2. Consolidated Wake Turbulence Groups.

Aircraft Consolidated Wake Turbulence Group	Percent Mix (%)	Runway Occupancy Time (s)	Typical Approach Speed (knots) from Final Approach Fix
E	5	59	145
F	54	52	139
G	28	51	133
H	13	49	125

a) Estimate runway 4R's arrival capacity in IMC conditions. Please show me a couple of sample calculations for Tij and Bij (one for the opening case and one for the closing case). Also, please show me the manual calculation of the gap (G) allowing one departure between successive arrivals.

b) Estimate the departure capacity of runway 4L in IMC conditions.

c) Draw the Pareto diagram (i.e., arrival-departure diagram) for the runway configuration shown in Figure 2.

d) If both runways are used in mixed operations (i.e., arrivals and departures on the same runway), draw the new Pareto diagram to represent the maximum number of arrivals and departures per hour. In your solution, assume 2.3 nm as the minimum distance between an arrival and a departure.

Problem 3 (30 Points)

To solve this problem, refer to the airport configuration shown in Figure 2. The airport is located at 345 feet above mean sea level.

a) Find out if each one of the objects in the figure is an obstruction to navigation. State the critical Part 77 surface for each object. Also, state any remedial action.

b) Will the 60-foot hangar violate the inner transitional OFZ surface of runway 4L? Assume ILS Category I operations. The critical aircraft is the Airbus A350-1000, shown in Figure 1.

c) Find the **minimum** distance between runway 4R and a parallel taxiway if two high-speed, acute-angle exits are to be constructed.

d) Generate a CAD drawing solution for a right-angle exit to be constructed 4,600 feet from runway threshold 4R. Use the minimum centerline radius required by the FAA. State all the necessary dimensions to build the fillet, including the fillet lengths, widths, centerline radius, and fillet radius.