Assignment 6: Air Traffic, and Runway Operations

Date Due: March 25, 2024 Instructor: Trani

Problem 1 Basic ATC and Runway Separations

Answer briefly the following ATC-related questions.

a) An Airbus A330-300 cruises at Mach 0.82 at FL 370 and 150 miles East of Labrador enroute to Europe. Name the ATC service that oversees the flight.

b) Over the ocean, explain how pilots communicate with Air Traffic Control. Describe the time lag in communications for oceanic flights and ATC.

c) State the minimum separation between two parallel runways to serve operations shown in Figure 1. State the surveillance equipment needed to make the operations shown possible.

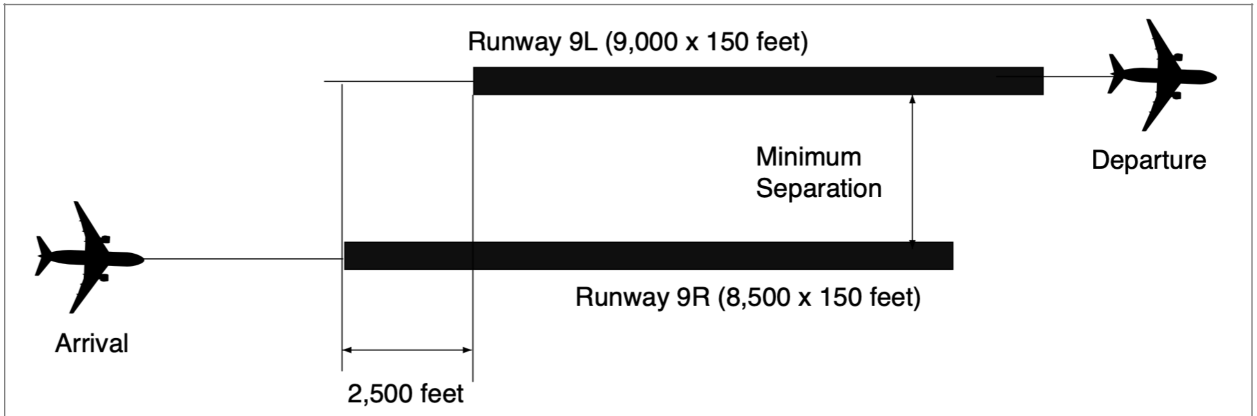

Figure 1. Runway Configuration.

d) Use Google Earth and the FAA airport diagram to familiarize yourself with the runway configuration at Los Angeles International airport. Can runways 24R and 25L be operated independently for simultaneous instrument arrivals? Comment on the rule used.

e) Can the Denver airport operate three simultaneous arrivals in West flow (flying to the West) in instrument conditions? Name the runways selected in such operations.

Problem 2 Runway Capacity

Figure 2 illustrates the configuration of the runways at the airport. Runways 9L and 9R serve different aircraft fleet mix.

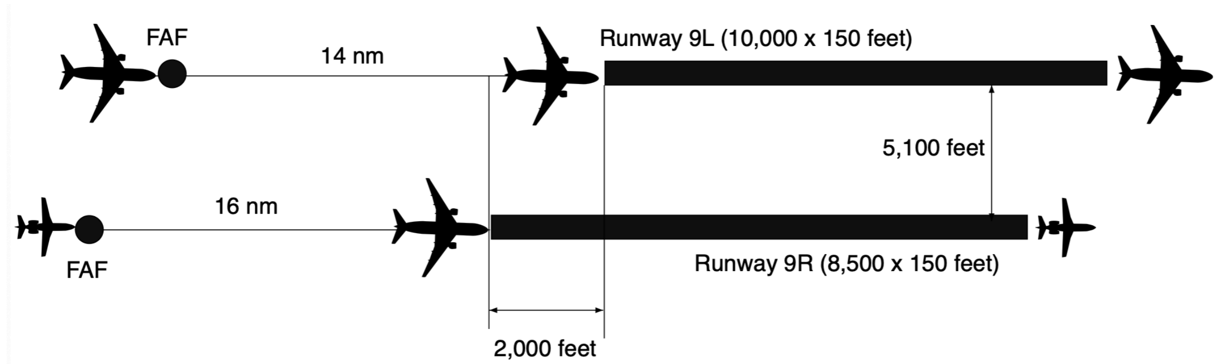

Figure 2. Runway Configuration for Problem 2.

Assume IMC conditions in the solution to the problem. The airport operates an East flow configuration with arrivals and departures using both runways. Tables 1 and 2 show the airport fleet mix for runways 9L and 9R, respectively. For this analysis we use the following technical parameters: a) in-trail delivery error of 17 seconds under IMC conditions, b) probability of violation is 5%. Arriving aircraft are "vectored" by ATC to the Final Approach Fix (FAF) for each runway, and c) 2.5 nautical miles minimum separation between an arrival and a departure. The 2.5 nm arrival-departure separation includes a small 0.5 nm buffer over the minimum value used in the US. Use the arrival-arrival separations for on-approach operations described in the consolidated wake vortex separation document (or notes). Table 3 shows the departure-departure separation matrix employed.

Table 1. Runway 9L Operational Parameters and Fleet Mix. CWT Groups.

Aircraft CWT Group	Percent Mix (%)	Runway Occupancy Time (s)	Average Approach Speed (knots) from FAF
B	6	61	150
E	18	59	145
F	76	55	138
Totals	100		

Table 2. Runway 9R Operational Parameters and Fleet Mix . CWT Groups.

Aircraft CWT Group	Percent Mix (%)	Runway Occupancy Time (s)	Average Approach Speed (knots) from FAF
F	48	55	138
H	26	49	126
I	26	45	118
Totals	100		

Table 3. Departure-Departure Separations with Buffers Included. Columns 2-6 are the Following Aircraft. First Column Presents the Lead Aircraft. Values in are seconds (includes 10-second departure buffers).

	Following Aircraft				
Lead Aircraft (Below)	**B**	**E**	**F**	**H**	**I**
B	130	130	130	140	140
E	95	120	130	130	130
F	70	70	70	70	90
H	70	70	70	70	70
I	70	70	70	70	70

a) Estimate the IMC arrivals-only capacities for runways 9L and 9R at the airport.

b) Estimate the IMC departures-only capacities for the airport.

c) runway capacities at the airport.

d) Show the complete Pareto diagram (arrivals and departures on both runways) for the airport under IMC conditions.

e) Comment on the differences in runway capacity between runways 9L and 9R.

Note: You can employ the Excel spreadsheet provided. However, you must show me some sample calculations.

Problem 3 Runway Capacity

Figure 3 shows the runway configuration for Problem 3. Use the technical separation parameters similar to those of Problem 2. Table 4 shows the fleet mix and ROT parameters of the airport. Use the departure-departure separations of Table 3 which include the departure-departure buffers.

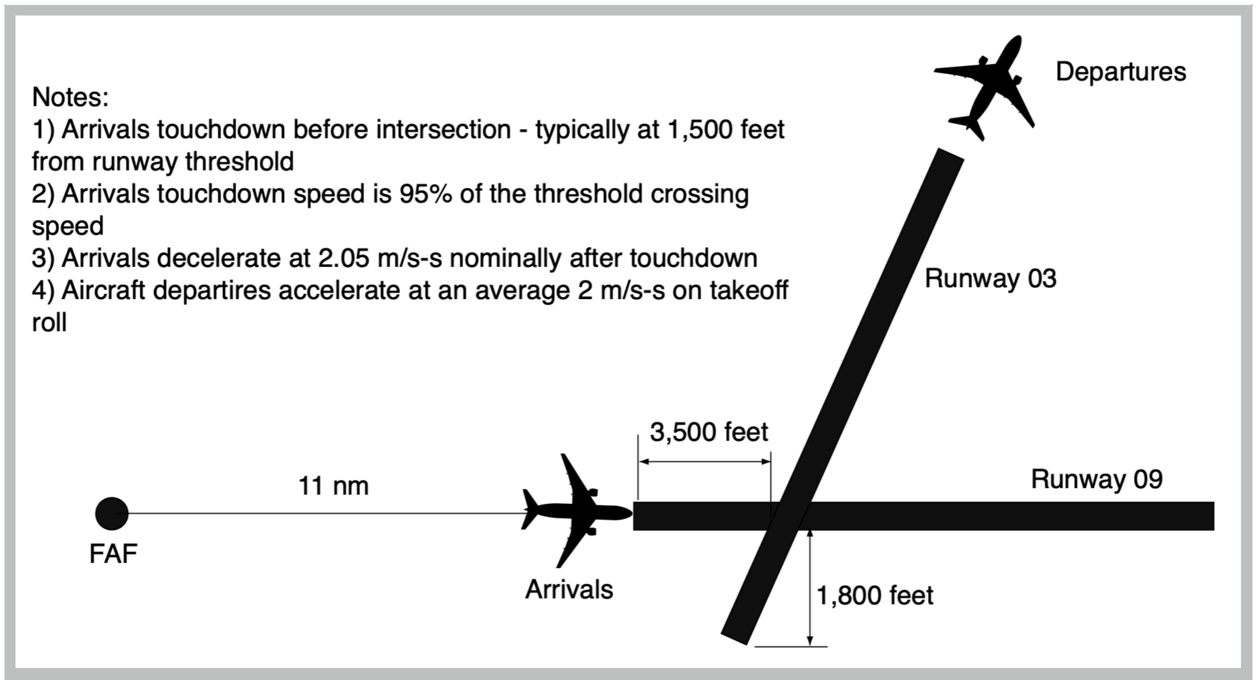

Figure 3. Runway Configuration for Problem 3.

Table 4. Operational Parameters and Fleet Mix for Problem 3.

Aircraft CWT Group	Percent Mix (%)	Runway Occupancy Time (s)	Average Approach Speed (knots) from FAF to Runway Threshold
F	69	62	139
G	13	60	134
H	18	54	125
Totals	100		

a) Estimate the IMC arrival and departure capacities for the two-runway system. Show me the procedure to estimate departures on runway 03.
b) Draw the IMC Arrival-Departure diagram for the configuration shown in Figure 3.
c) If the airport ATC decided to operate additional departures on runway 09, estimate the new departure capacity with 100% arrival priority on runway 09 and 100% departures on runway 03.