CEE 5614: Analysis of Air Transportation Systems Fall 2013

Assignment 8: Runway Capacity Analysis

Date Due: November 4, 2012 Instructor: Trani

Problem 1

Read a recent safety recommendation made by the National Transportation Safety Board about potential midair collisions at airports. The recommendation is available at: http://www.ntsb.gov/doclib/recletters/2013/A-13-024.pdf. Answer the following:

a) Develop a simple set of rules for operations on runways with intersecting paths to avoid the types of incidents described in the safety recommendation.

b) Perform simple calculations to demonstrate that your rule(s) developed in part (a) works. Assume typical approach speeds of 130-150 knots and takeoff speeds of 140-180 knots for commercial aircraft.

c) Describe in words what would be the impact of new safety rules on runway capacity.

Problem 2

Examine solution to problem on page 28 of the handout Notes 5b: Three dependent runways.

a) Develop a new Pareto diagram for the 3 runways operated as shown in Figure 1. This requires the estimation of departures on both runway 36 (as executed in class) and also departures on runway 09L using the natural arrival gaps of aircraft landing on runway 09L.

b) How different is the new Pareto compared to that shown on page 63 of the Notes 5b handout? Comment.

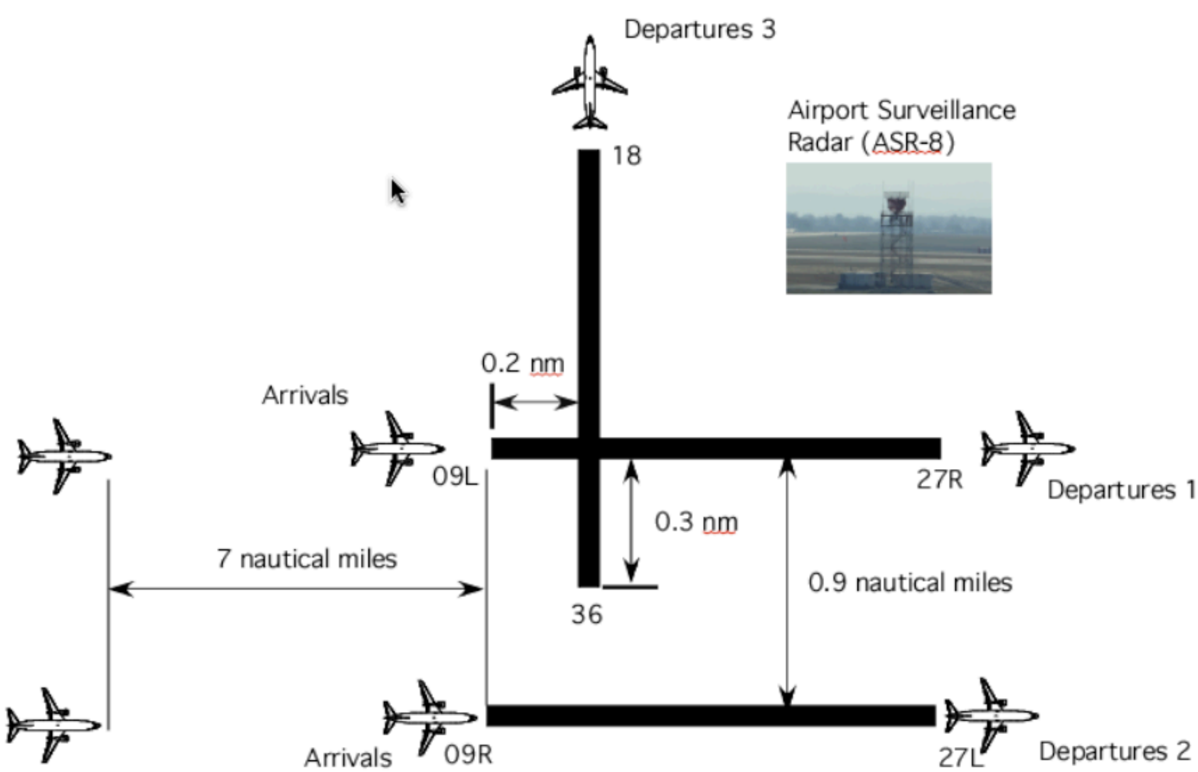

Figure 1. Runway Configuration for Problem 2.

Problem 3

The problem deals with a converging runway configuration as shown in Figure 2.

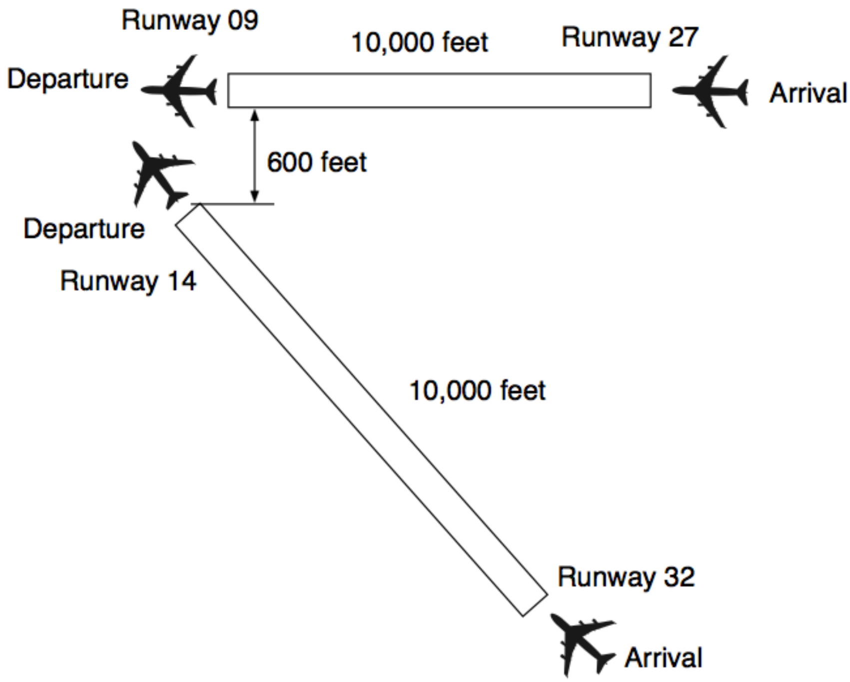

Figure 2. Runway Configuration for Problem 1. Dependent Approach Procedures.

a) Find the IFR arrival saturation capacity of the runway configuration shown in Figure 2. In your analysis consider the dependency between arrival operations to converging runways. Assume that an arrival on runway 32 has to be 2 nm away from the threshold 32 as the arrival on runway 27 crosses the threshold. This provides one minute time separation between successive arrivals in case of a go-around.

b) Estimate the departure saturation capacity and the complete Pareto diagram for IFR conditions. Since aircraft will be intersecting paths while airborne, allow one minute separation between departures on distinct runways behind "Large" and "Small" and 2 minutes behind "Heavy" aircraft.

Table 1. Runway Operational Parameters and Fleet Mix for Problem 3.

Aircraft	Percent Mix (%)	Runway Occupancy Time (s)	Approach Speed (knots)
Small	5	45	125
Large	85	55	145
Heavy	10	65	150

Table 2. Minimum arrival-arrival separations under IMC conditions. Values in are nautical miles. Values Shown Do Not Include Buffers.

Minimum Separation Matrix (nm)		Arrivals-Arrivals			
		Trailing Aircraft (Header Columns)			
Lead (column 1)	Small	Large	B757	Heavy	Superheavy
Small	2.5	2.5	2.5	2.5	2.5
Large	4	3	2.5	2.5	2.5
B757	5	4	3	3	2.5
Heavy	6	5	4	4	4
Superheavy	10	10	10	10	10

Table 3. Minimum departure-departure separations under IMC conditions on the same runway. Values in are seconds.

Departure-Departure Separation Matrix (seconds)					
		Trailing Aircraft (Header Columns)			
Lead (column 1)	Small	Large	B757	Heavy	Superheavy
Small	60	60	60	60	60
Large	90	60	60	60	60
B757	120	120	60	60	60
Heavy	120	120	120	120	90
Superheavy	150	120	120	120	120