**CEE 5614: Analysis of Air Transportation Systems** **Spring 2026**

# Quiz 2 : Open Notes

Date Due: April 28, 2018 (via Canvas) Instructor: Trani

## Instructions

Write your solutions in the spaces provided. Add any additional pages with calculations as needed. Make sure each additional page has your name.

### 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 (40 Points)

Perform an assessment of the IMC runway capacity at LGA airport. You can use Google Earth to estimate distances to the runway intersection point. The runway configuration is such that landing aircraft touchdown before the intersection (i.,e., neglect wake vortex effects of a landing aircraft on a departure on the intersecting runway departure). Aircraft accelerate on a runway at 2.2 $m/s^2$ and the touchdown speed is close to 95% of the runway threshold speed. Assume aircraft accelerate at 2.0 $m/s^2$ on the runway.

The airport has an advanced Precision Runway Monitor surveillance radar which tracks aircraft up to 50 miles form the airport site. Assume the ATC probability of violation is 5% with standard deviation of the in-trail delivery error at 16 seconds due to the installation of a PRM radar (i.e., faster update rate). Use the arrival-arrival separations included in the Aircraft Classification handout. The airport has good runway exits and hence minimum radar separation is 2.5 nm. Tables 1 and 2 shows other technical parameters.

*Table 1. Runway Operational Parameters and Fleet Mix for LGA Airport.*

| Aircraft RECAT Group | Percent Mix (%) | Runway Occupancy Time (s) | Typical Approach Speed (knots) at Threshold VREF | Typical Takeoff Speed (knots) |
|---|---|---|---|---|
| F | 62 | ~50 | 140 | 150 |
| G | 38 | ~49 | 135 | 145 |
| Totals | 100 | | | |

*Table 2. Departure-Departure Separations with Buffers Included. Columns are the Following Aircraft. First Column Presents the Lead Aircraft. Values in are seconds (include departure buffers).*

| Aircraft | D | E |
|---|---|---|
| D | 70 | 70 |
| E | 70 | 70 |

a) Draw the IMC Pareto Frontier diagram (arrival and departure capacity diagram) under IMC conditions when arrivals are conducted on runway 22 and departures on runway 13. Show me at least three operating points in the diagram (arrivals only, mix operations, and departures only capacities).

b) a) Draw the IMC Pareto Frontier diagram (arrival and departure capacity diagram) under IMC conditions when arrivals are conducted on runway 04 and departures on runway 31. Show me at least three operating points in the diagram (arrivals only, mix operations, and departures only capacities).

c) Comment on the shape and numerical answers of parts (a) and (b). What configuration is better?

# Problem 2

Read the article about NASA's truss-braced wing aircraft studies: https://ntrs.nasa.gov/api/citations/20240007120/downloads/ICAS-2024-TTBW-Paper-20240606.pdf and answer the following questions:

a) Explain some of the refinements made to the truss-braced aircraft concept across various phases.

b) Explain the fuel consumption gains of the new concept.

c) Are there any drawbacks of the TTBW concept to operate at airports? Comment.

# Problem 3

Use the new generation Transonic Truss-Braced Wing (TTBW) aircraft provided in class (http://128.173.204.63/courses/cee5614/cee5614_pub/SUGAR_class.m ) to answer the following questions. The TTBW aircraft is pictured in Figure 1.


Figure 1. Transonic Truss-Braced Wing Aircraft. Source: NASA and Boeing.

A) Compare the point performance of the TTBW aircraft against the Boeing 737-800 class aircraft provided in class (http://128.173.204.63/cee5614/cee5614_pub/Boeing738_class.m). Assume both aircraft fly at FL 360 and Mach 0.77. The TTBW weight at FL360 is 67,000 kilograms and the Boeing 737-800 is 75,000 kilograms. Your comparison should consider two metrics such as: fuel burn, SAR, and excess thrust.

B) Find the maximum speed in level flight for the TTBW aircraft at FL 380 with a weight of 65,000 kilograms. Show me the method used to find the maximum speed.