

Quiz 1 - Take Home (Due October 16, via Canvas)

Open Notes and Internet

Instructor: A.A. Trani

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, FAA nomographs, and others if you want to receive partial credit.**


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 **future runway length requirements at Roanoke/Blacksburg Regional Airport (ROA)**. A new airline would like to operate from ROA using the Boeing 737-8 (Boeing 737-8 Max) with characteristics shown in Figure 1. The runway assessment considers flying from ROA to Denver (DEN) and Dallas Fort-Worth (DFW) non-stop with 178 passengers. For this analysis, use the latest version of the Boeing documents for airport design.

Aircraft	Engine	Remarks
Boeing 737-8 (Max) equipped with CFM LEAP-1B25 engines. Aircraft maximum design takeoff weight is 179,800 lbs. and 178 seats in a two-class layout. Based on the payload-range diagram, the aircraft operating empty weight is estimated to be 99,000 lbs.		
		
Figure 1. Aircraft Considered in Problem 1. Picture Source: A.A. Trani.		

- Find the runway length needed to operate future services from ROA to DEN and DFW. Assume higher emissions in the future (due to climate change). State the design temperature used.
- Considering the existing condition at ROA, what is the runway improvement needed?
- Use Google Earth to draw a polygon representing the required runway calculated in part (a). Assume that any runway extension will be done on runway threshold 06 (see Figure 2).
- If the runway safety areas are to be protected on runway 06-24 at ROA after the improvement, estimate the size of the additional area required on the runway. Draw your solution using Google Earth to show the additional area to be impacted by the project.
- Explain some of the challenges to complete a runway improvement at ROA.
- Considering the runway improvement estimated in part (a), if the aircraft is loaded with 83% of the passengers (average load factor in US domestic flights), can the future airport support flights from ROA to Los Angeles?
- With the runway improvement of part (a), can a Gulfstream 450 fly from ROA to London Heathrow airport non-stop? Explain.

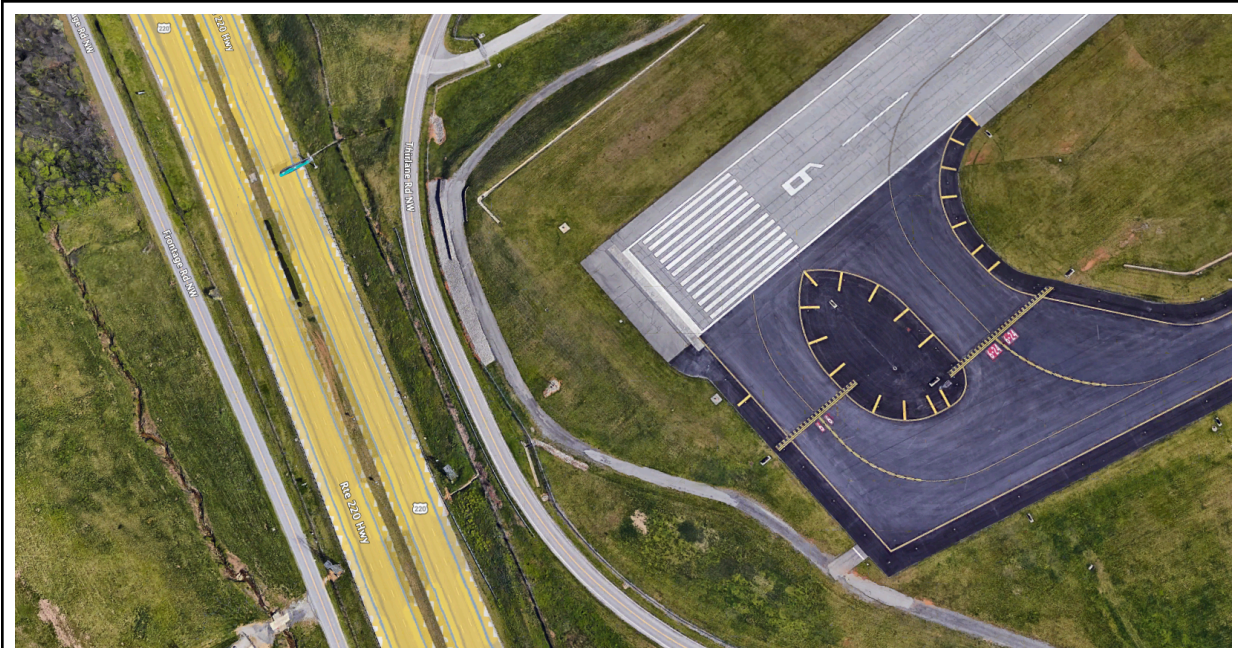


Figure 2. Roanoke Airport Runway End 06.

Problem 2 (30 Points)

Use the Small Aircraft Runway Length Analysis Tool (SARLAT) to evaluate the Perry Stokes Airport (TAD) runway near Trinidad, Colorado. The airport serves single, multi-engine piston, and turboprop aircraft (Table 2). Use a Higher Emissions scenario in your runway evaluation and design scenarios.

Table 2. Aircraft Fleet Mix for Problem 2 (Runway Evaluation).

Aircraft Type	Aircraft	Annual Arrivals	Annual Departures
Piston	Cessna 182	3190	3190
Piston	Cirrus SR20	1830	1830
Piston	Diamond DA40	1450	1450
Piston	Cessna 421C	430	430
Turboprop	Turbo Commander 690B	340	340
Turboprop	Cessna 208 Caravan	305	305
Turboprop	Socata 850	250	250
Jet	Cessna Citation Jet 2	300	300
Total		8095	8095

Perform a **runway evaluation** of the current runway length available at the airport and answer the following questions.

- a) Is the runway length available suitable for all aircraft? Explain any issues found.
- b) For the fleet mix in Table 2, state the aircraft that operates with the largest number of restrictions if the runway is wet at TAD.
- c) On a rainy day, how far can the Cessna Citation Jet 2 fly with four passengers and the flight crew?

Runway improvement scenario

- d) As part of a new airport master plan study, **calculate a runway length improvement**, allowing mid-size jets like the Cessna Citation Latitude to operate with **70% useful load from the airport with a wet runway**.
- e) Can the Cessna Citation Latitude fly from TAD to SEA (Seattle-Tacoma International Airport) with a wet runway with your proposal of part (d).
- f) With your proposed runway length improvement in part (a), is the Cessna Citation Jet 2 able to operate at a higher takeoff weight? Explain.

Problem 3 (30 points)

Short answer.

	Question	Short Answer
1	Roanoke Regional airport has a EMAS able to stop a Gulfstream GIII traveling at 70 knots and overrunning the runway after landing on runway16.	
2	The Airbus A321neo taxiway design group.	
3	The Douglas DC-8 was a successful twin engine, turboprop-powered aircraft.	
4	Runway 1 at Reagan National Airport is a precision runway with approach lights.	
5	Increase in RSA longitudinal dimensions when a runway transitions from RDC C-II-5000 to D-V-2400.	
6	Maximum height of an object located 600 feet from the runway centerline. The critical aircraft is the Boeing 747-8 and the airport elevation is 2,400 feet. Only check the Inner transitional OFZ.	
7	The AAC group for the Airbus A220-300.	
8	90% of the aircraft overrun accidents on a runway are contained within 1,000 feet of the runway end.	
9	Aircraft design group for the Boeing 737-10 Max.	
10	Length of the inner-approach OFZ area if a runway has a 2,400 foot approach light system.	