Assignment 3: Runway Length Analysis and EMAS Calculations

Date Due: February 12, 2017 Instructor: Trani

Problem 1

a) Tabulate the specifications for ROFA, OFZ (including the dimensions of the inner transitional surface), RSA and RPZ for a new runway at Portland International airport in the US. Consider the critical aircraft to be the Airbus A350-900.

Airbus A350-900 dimensions:

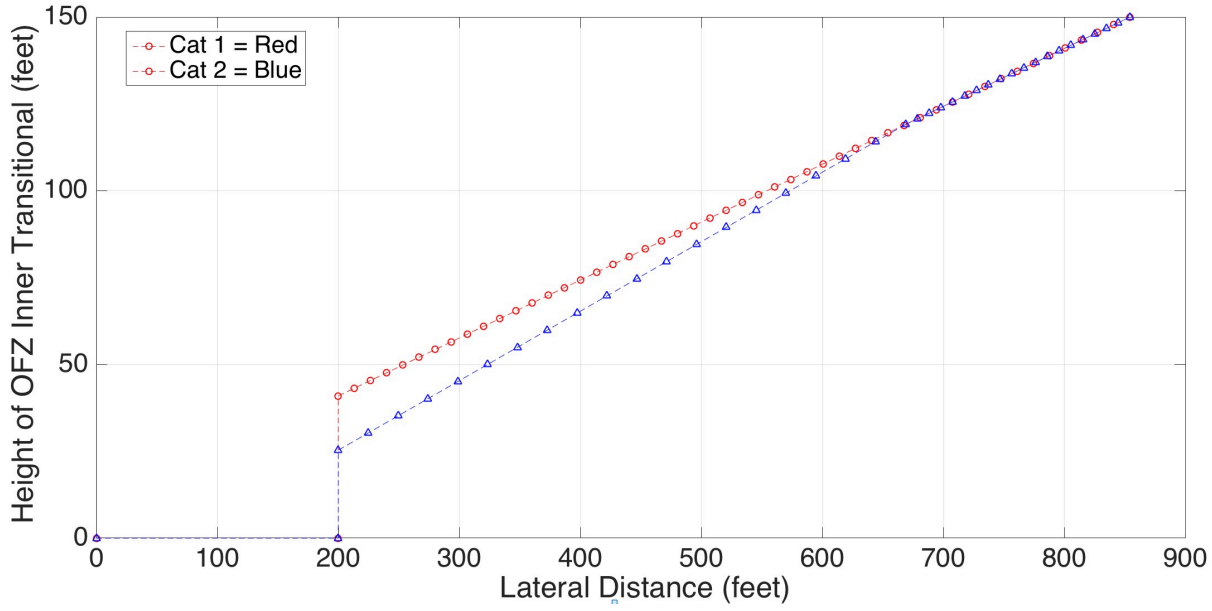
wingspan = 64.65 meters (212 feet)

tail height = 17.05 meters (55.92 feet)

airport elevation = 30 feet

b) How close to the runway centerline can an airline construct an 80 foot tall hangar without violating the inner transitional OFZ?

See dimensions of the OFZ in the figure below. The minimum distance for the OFZ to clear 80 feet is 435 feet for Category 1 approaches and 473 feet for Category 2 approaches. Both solutions are shown in the figure below.



Inner Transitional OFZ surface for Airbus A350-900. Dimensions are the lateral distance from the Runway Centerline.

c) Draw your surfaces in the CAD application of your choice. Draw to scale and label accordingly.

Problem 2

Use Google Earth and review the Roanoke Regional Airport to answer the following questions.

The Roanoke-Blacksburg Regional airport has an EMAS system installed on runway threshold 16 (on the North of the airport). Verify and identify using Google Earth. The largest aircraft operating at ROA are a Federal Express Boeing 757-200 cargo plane (similar to that shown in Figure 1) and a United Parcel Service (UPS) Airbus A300-600 cargo plane. The largest commercial passenger aircraft operating today is the Boeing 737-700 operated by Delta Airlines.

Figure 1. Boeing 757-200 Cargo in UPS Colors (A. Trani).

a) Find the approximate length of the EMAS installed at ROA on runway end 16. Use the Google Earth measuring tool.

ROA EMAS is around 310 feet long. However, there are 300 feet prior to the EMAS (blast pad area).

b) Estimate the length of an EMAS system to stop an aircraft of the size of the Boeing 757-200 (Maximum takeoff weight is 255,000 lbs). Refer to FAA AC 150/5220-22A to estimate the parameters of your design. Use the recommended FAA design speed for the EMAS design.

According to FAA the minimum dimension of the EMAS to stop a Boeing 757-200 is 450 feet using a design speed of 70 knots.

c) Is the EMAS installed at ROA consistent with the design found in part (b)? Explain.

Technically no. The EMAS at ROA seems to be sized for a Bombardier CRJ-200 regional jet. Or it could stop a Boeing 757-200 at 53 knots.

Problem 3

An airline is studying adding new regional jet services from Charlottestville, VA airport to Houston Intercontinental airport (in Texas). The airline is planning to purchase two second-hand Airbus A319-200 with Snecma/GE CFM56 engines. The aircraft of interest have a maximum takeoff mass of 70,000 kg and seat 145 passengers in a single class configuration. The airline flight planning department estimates 41 kilograms per minute for this trip. Additional 1,200 kilograms of fuel is carried as contingency. The aircraft cruises at 420 knots average between these two cities.

Airbus A319 Takeoff Runway Performance from CHO at 55,571 kilograms. ISA + 15 deg. C.

d) Find if the existing runway at CHO is long enough to support this operation in a hot summer day.

The distance from KCHO to KIAH is 1,020 nm adjusted with a 5% detour factor.

Use WV005 from the aircraft performance table provided by Airbus. MTOW = 70,000 kg. Aircraft takes 2.42 hours to fly from CHO to IAH. The fuel planned for the route is then:

OEW = 39,725 kg.

FW = 41 (kg/min)(2.42 hrs)*60(min/hr)+1200 kg = 7,153 kg.

PYL = 145 (passengers) * (100 kg/passenger) = 14,500 kg

DTW = OEW + PYL +FW = 39,725 kg + 14,500 kg + 7,153 kg

The Desired Takeoff Weight (DTW) for this route is 61,378 kg (135,030 lb.).

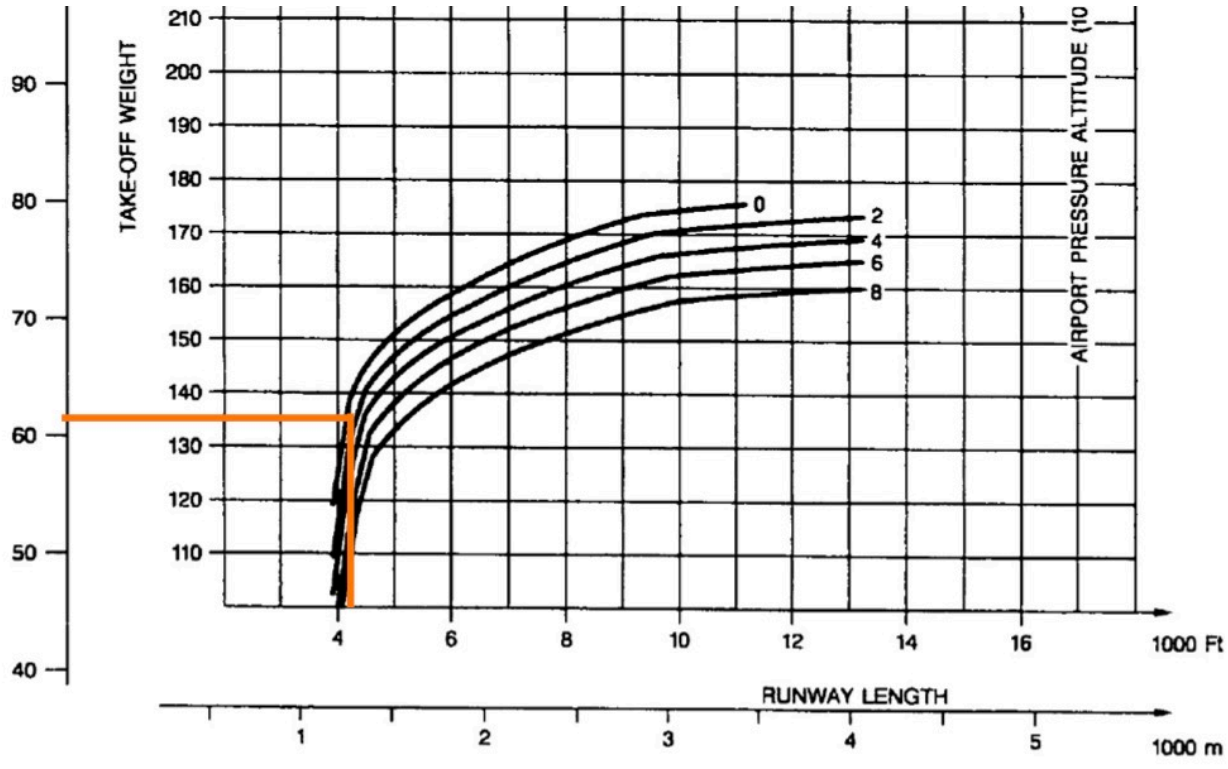
Uncorrected takeoff distance is around 4,100 feet. Available runway length is 6,801 feet. A 0.3% grade translates into 20.4 ft difference between centerline elevations. Add 200 feet to the solution

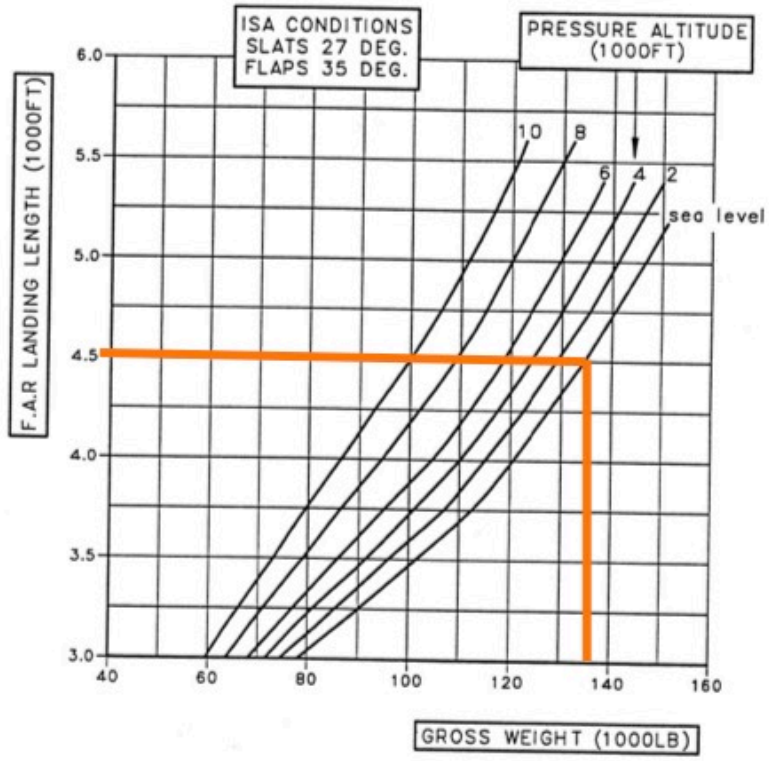
Corrected takeoff distance is 4,300 feet.

Landing distance is estimated based on landing mass of 61,378 kilograms (not MALW because the aircraft is operated below the MALW). The landing distance is 4,500 feet.

The landing distance is dominated by the landing. Runway length needed is 4,500 feet.

		WV000	WV001	WV002	WV003	WV004	WV005	WV006
Maximum Taxi Weight (MTW)	kg	64 400	70 400	75 900	68 400	68 400	70 400	73 900
	lb	141 977	155 205	167 330	150 796	150 796	155 205	162 921
Maximum Takeoff Weight (MTOW)	kg	64 000	70 000	75 500	68 000	68 000	70 000	73 500
	lb	141 095	154 323	166 448	149 914	149 914	154 323	162 039
Maximum Landing Weight (MLW)	kg	61 000	61 000	62 500	61 000	62 500	62 500	62 500
	lb	134 481	134 481	137 788	134 481	137 788	137 788	137 788
Maximum Zero Fuel Weight (MZFW)	kg	57 000	57 000	58 500	57 000	58 500	58 500	58 500
	lb	125 663	125 663	128 970	125 663	128 970	128 970	128 970
Estimated Operational Empty Weight (OEW)	CFM Engines	39 725 kg (85 579 lb)						
	IAE Engines	39 826 kg (87 801 lb)						
Estimated Maximum Payload CFM	kg	17 275		18 775	17 275	18 775		
	lb	38 084		41 391	38 084	41 391		
Estimated Maximum Payload IAE	kg	17 174		18 674	17 174	18 674		
	lb	37 862		41 169	37 862	41 169		
Standard Seating Capacity	single-class	145						
Usable Fuel	l	23 859						
	US Gallons	6 302						





Problem 4

Review the accident of an Embraer E190 at Cuenca (in Ecuador) on April 28, 2016. The accident information is found at: http://avherald.com/h?article=4978aed0&opt=0.

a) Does the airport meet the runway safety area criteria? Explain.

No

b) Suggest measures to reduce the risk that future accidents cause loss of life at this airport.

Relocate people and build a compliant runway safety area.