

Assignment 3: Runway Length Analysis

Date Due: February 11, 2016

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Problem 1

The San Diego International Airport would like to request your services to estimate if an airline can operate a new nonstop service San Diego to Shanghai Pudong International Airport (PVG) using Boeing 787-9 with General Electric engines and a maximum takeoff weight of 560,000 lb.

- Find the route distance from San Diego (SAN) to Shanghai (PVG). Use a 5% detour factor above the Great Circle Distance (GCD).
- Find the runway length needed to operate this non-stop service from SAN. Assume the aircraft has a two class configuration.
- Look at the existing runway conditions at SAN. Do you need a runway extension? Comment.
- With the existing runway and full passengers estimate the maximum "belly cargo" load the Boeing 787-9 could carry departing from runway 27 at San Diego.

Problem 2

A new international airport has been considered for San Diego. Estimate the runway length requirement for the same Boeing 787-9 departing San Diego but, in your new design, provide maximum flexibility for the airline to operate the aircraft at maximum takeoff weight. Use the Boeing 787-9 with General Electric engines and a maximum takeoff weight of 560,000 lb.

- Find the runway length needed to operate the Boeing 787-9 from the proposed new airport. Assume the aircraft has a two class configuration.
- Compare the runway length requirements found in part (a) with those found in Problem 1(b). Compare your answers.

Problem 3

Use Google Earth and refer to the Charleston, WV airport to answer the questions below. The airport has an EMAS installed on runway threshold 5. Check that out using Google Earth.



Figure 1. Lockheed C130 Hercules. source: https://en.wikipedia.org/wiki/Lockheed_C-130_Hercules#/media/File:Lockheed_C-130_Hercules.jpg

- a) Find the approximate length of the EMAS installed at CRW on runway end 5. use the Google Earth measuring tool.
- b) Estimate the length of an EMAS system to stop an aircraft of the size of the Lockheed C130 - Hercules (Takeoff weight is 150,000 lbs. and the aircraft is shown in Figure 1). The C130 has approach speeds of around 127 knots at MALW. Refer to FAA AC 150/5220-22A available on our home page. Use the recommended FAA design speed for the EMAS design.
- c) Is the EMAS installed at CRW consistent with your design found in part (b)? Explain.
- d) Estimate the accelerate and stop distance available (ASDA) for an aircraft departing runway 5 at CRW. In your analysis consider that the runway safety area on the departure end of the runway needs to be protected. The critical aircraft for the airport is the Lockheed C130 Hercules flown by the US National Guard at CRW.
- e) What is the length of the RSA considered in part (d)?

Problem 4

An airline is studying adding new regional jet services from Charleston, WV airport to Orlando International airport in Florida. The airline has Embraer 175 (standard version) with CF-34-8E5 engines (similar to the aircraft shown in Figure 1). The aircraft belonging to the airline have a maximum takeoff mass of 37,500 kg and seat 78 passengers. The airline flight planning department estimates 4500 kg of fuel for the trip to Orlando (using average fuel burn for planning purposes is 32 kg/minute plus fuel reserves).

- a) Estimate if the existing runway at CRW is long enough to support this operation in a hot summer day.
- b) How much extra payload can the airline carry before the runway length at CRW is reached?



Figure 2. Embraer 170 on Final Approach to Chicago O'Hare International Airport. source: A.A. Trani.