

Assignment 4

Date Due: February 16, 2018

Instructor: Trani

Problem 1

Familiarize yourself with Chapter 6 of the AC 150/5300-13A before trying this problem.

Research in the internet and in Chapter 6 of the FAA AC 150/5300-13a the following airport systems.

a) In a short statement explain what is the purpose of the system and whether or not the system can be located inside the Runway Object Free Area (ROFA) and Runway Safety Area (RSA).

1. Precision Runway Monitor (PRM)

Fast scan radar is used for aircraft surveillance. Precision runway monitor (PRM) is a high-speed, high-precision radar system developed by Raytheon to monitor simultaneous close parallel instrument approaches to airports.

2. ILS Localizer Antenna (LOC) and ILS Glide-slope antenna (GS)

Instrument landing system localizer and ILS Glide-slope antenna (GS) is a system of horizontal guidance in the instrument landing system, which is used to guide aircraft along the axis of the runway.

NAVAID	Fixed-By-Function		
	In RSA	In ROFA	Associated Equipment
Airport Beacon	No	No	N/A
ALS	Yes	Yes	No ¹
ASDE-X	No	No	N/A
ASOS, AWOS	No	No	N/A
ASR	No	No	N/A
ATCT	No	No	N/A
DME	No	No	No
GS	No ²	No ^{2,3}	No
IM	Yes	Yes	Yes
LDIN	Yes	Yes	No ¹
LOC	No	No	No
LLWAS	No	No	No
MM	No	No	No
NDB	No	No	N/A
OM	No	No	No
PRM	No	No	No

b) Read the FAA document https://www.faa.gov/training_testing/training/prm/media/PRM_training.pdf and explain why Chicago ORD Airport can conduct PRM procedures to runways 10C and 10R. Explain the distance between runways and comment on the FAA runway separation criteria used.

3200

PRM approaches are independent, simultaneous operations to runways spaced between 3000 and less than 4300 feet apart. The approach courses are normally parallel but may be offset by between 2.5 and 3.0 degrees depending on the runway separation.

Problem 2

Use Google Earth software and Airnav (www.airnav.com) when applicable, to answer the following short questions.

Seoul International Airport (ICN)

- a) Can **simultaneous approaches** be conducted on runways 34 and 33R in Instrument conditions? Explain the ICAO rule that applies and the distance between the two runways in question.

Runway Separations according to ICAO

1035 m for independent parallel approaches. Hence the arrivals can be processed independently at ICN airport on runways 34 and 33R. One aspect to consider is that ICN is close to the DMZ zone. This requires left turns while departing to the north of the airport.

Chicago O'Hare International Airport (ORD)

- a) Can ATC conduct simultaneous approaches to three runways at ORD in IMC conditions? Select the three most likely runways used for arrivals if the wind is reported from 270 degrees at 10 knots. Explain the FAA rule used and the distance between the runways in question. Remember, aircraft prefer to land against the wind. State the reason for your runway selection.

Yes. 9L 9R 10C

Independent Triple Approaches: 5000 feet or more

- b) Can ATC conduct simultaneous departures using three runways at ORD in IMC conditions? Explain the FAA rule used and the distance between the runways in question.

If arrivals are very light, three runways may be operated nearly independently.

Converging Runway Operations (CRO)

Non-Intersecting Converging Runway Operations

CRO Distance between 16/27R 14R/32L is less than 1 nm

Baltimore-Washington International Airport (BWI)

- b) Can simultaneous approaches be conducted to runways 33R and 33L in IMC conditions? Explain the FAA rule used and the distance between the two runways in question.

Yes. Runways have enough separation (~4650 feet).

- c) Can the airport operate simultaneous arrivals on runway 10 and departures on runway 15L in VMC conditions? Explain the FAA rule that controls operations from Open-V runways.

This configuration is an example of the Converging Runway Operations (CRO). The thresholds of runway 33R and runway 28 are separated by 1300 feet (much less than a nautical mile). The CRO rules apply. No independent operations are possible as described.

Raleigh-Durham International (RDU)

- b) Can aircraft fly simultaneous approaches to runways 23L and 23R in IMC conditions? RDU has a precision runway monitor radar (PRM). Explain the FAA rule used and the distance between the two runways in question.

Parallel runway separation is 3500 feet. Independent Approaches to Parallel Runways (IFR) are possible under PRM. A minimum separation of 3000 feet is required.

- c) Can the airport operate simultaneous departures from runways 5L and 5R in IMC conditions? Explain the FAA rule used.

Yes, the minimum separation required is 2500 feet for independent parallel departures and arrivals.

Problem 3 - Airport Operations in Close Parallel Runways

Use Google Earth application and your knowledge of runway safety areas to answer the following question. Figure 1 shows two simultaneous departures from San Francisco International Airport runways 1L and 1R. You are required to watch the movie <https://www.youtube.com/watch?v=PLiZCkVQwgk> to get an appreciation of the procedure used at SFO.

- a) Estimate (using Google Earth) the distance between runway centerlines between runways 1R and 1L.
- b) Estimate the dimensions of the OFZ for runway 1L using the Boeing 737-700 as the critical aircraft for this analysis. Is the Airbus A320-200 outside of the OFZ for runway 1L as the planes depart (Category 1)? Is the A320 outside of the ROFA and the RSA areas for runway 1R? Comment.

OFZ for Boeing 737-700 at Runway 1R

Tail height of A320-200 (Runway 1L) and check

RSA and ROFA for runway 1R and check A320 (Wingspan)

- c) Based on the movie (skip to 2:00 minutes into the movie to see the actual takeoff), do the aircraft start the takeoff roll simultaneously? Comment on the operational implications of simultaneous departures in the context of wake vortex effects between the aircraft. The movie shows an Airbus A320 taking off from runway 1R and a Boeing 737 (United) taking off from runway 1L.

Yes. The idea behind this is to bring aircraft side by side to avoid wake effects.

- d) After the aircraft are in the air, what sort of maneuver is conducted to maintain the safety of the operations?

A breakout maneuver (15 degree change in heading) is performed by each departing aircraft.

- e) Watch movie <https://www.youtube.com/watch?v=lwrUxQZPIOo> to gain an appreciation of SFO Simultaneous Offset Independent Approaches (SOIA). Are the two aircraft flying the same glide slope? Comment.

Yes. The idea behind SOIA is to bring aircraft near side by side to avoid wake effects. The Glideslope of the Southwest aircraft (landing on runway 28L) seems lower than that for runway 28R.

- f) During the morning period, the number of departures at George Bush Intercontinental/Houston Airport (IAH) conducts simultaneous (paired) departures using runways 15L and 15R in VMC conditions. Find the separation between the runways and comment on the rule for simultaneous departures using close parallel runways in the US.

1000 feet between close parallel runways.



Figure 1. Simultaneous Departures at SFO Airport. Alaska Airlines Boeing 737-700 Departs from Runway 1R and Virgin America uses Runway 1L. VMC Conditions (A. Trani).

Problem 4

Briefly answer the following questions:

- a) Estimate the percent of runways in the US constructed with Asphalt.

23.78%

- b) Estimate the percent of paved runways in the US whose length is equal or less than 5,000 feet.

76.27%

- c) An American Airlines A320 departs Chicago O'Hare Airport (ORD). The destination is Los Angeles (LAX). The pilot requests an initial altitude to be flown. Which of the two altitudes below is allowed for this flight?
- 37,000 feet
 - 38,000 feet

Explain the reason for your selection.

ORD to LAX

Flight from ORD to LAX flies a Heading going West (262°). This implies 38,000 feet should be used for West headings.

- d) An aircraft traffic controller separates traffic 20 nm from Roanoke, Virginia. If two aircraft are 20 nm from the radar antenna, what is the minimum horizontal separation used? Assume no wake vortex effects.
- Aircraft location is less or equal than 40 nm from radar antenna
The standard Horizontal Separation is 3nm

- e) ATC controllers observe an aircraft flying at flight level 330 over West Virginia. What is the altitude - in feet - of this aircraft above sea level? What is the general direction of this flight (i.e., North, South, East, West, etc.). Explain.

FL330 (33,000 feet)

Direction: East