## Assignment 5: Runway Obstacles and Wind Rose Analysis

Date Due: March 2, 2018 Instructor: Trani

# Problem 1

a) A hotel company proposes to build a 135-foot tall building to be located 7,220 feet from the approach end of **a precision runway**. The hotel would be located 1,130 feet to the right of the extended centerline of the runway. Determine if the proposed hotel is an obstruction to navigation.

b) Determine if a new 216 foot antenna to be constructed 11,900 feet from the **runway threshold of a non-precision runway.** The antenna would be constructed along the extended runway centerline. Determine if the proposed antenna is an obstruction to navigation. State the critical Part 77 imaginary surface or other rules that apply at the location of the proposed antenna.

c) Check if an 35 foot tall tree located at a point 1,200 feet from the end of **a precision runway** and offset 750 feet from the extended runway centerline constitutes an obstacle to navigation according to FAR Part 77 rules.

d) Find if the 35 foot tall tree described in part (c ) penetrates the departure surface for instrument runways according to FAA AC 150/5300-13a (Figure 3-4). Comment on how the new siting requirements stated in the FAA AC 150/5300-13a compare to the old FAR Part 77.

# Problem 2

Obtain the runway dimensions Shenandoah Valley Airport (SHD) Airport using the Airnav database or Google Earth if necessary. Note that runway 5 is a precision runway end (it has an ILS system), runway 23 is a non-precision runway end. Draw to scale (in plan view only) the imaginary surfaces for this runway.

**Bonus Points (3 additional points in this homework) - export your CAD drawing and overlay in Google Earth using the overlay procedure explained in class.**

# Problem 3

A new airport location has been proposed and wind data has been collected (shown in Table 1). The airport is expected to receive a few commercial flights with the Bombardier Q400 and Embraer 170 as representative regional aircraft. For this analysis use the FAA Java application for wind rose available at: https://airports-gis.faa.gov/airportsgis/publicToolbox/windroseForm.jsp.

a) For the proposed airport, find the design crosswind component according to FAA criteria.

b) Find the optimal runway orientation for the runway (or runways) for the airport using the wind data provided in Table 1. Plot the runway orientation vs. the coverage achieved for every runway orientation every 10 degrees and indicate the optimal runway orientation in your plot. Show your proposed wind rose for the optimal solution indicating the coverage obtained using both runway thresholds.

c) If the airport is designed in India, what changes in the Wind Rose analysis would you consider. Explain.

*Table 1. Wind Data for New Airport. Speeds are Shown in knots (i.e., nautical miles per hour) in the Table Header.*

| Azimuth (degrees) | 0-3 | 4-6 | 7-10 | 11-16 | 17-21 | 22-27 | 28-33 | 33-40 | 41 and over |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 345 | 156 | 110 | 15 | 5 | 1 | 0 | 0 | 0 |
| 20 | 302 | 210 | 150 | 24 | 12 | 3 | 0 | 0 | 0 |
| 30 | 285 | 189 | 140 | 122 | 6 | 2 | 0 | 0 | 0 |
| 40 | 423 | 209 | 121 | 45 | 11 | 0 | 0 | 0 | 0 |

| Azimuth (degrees) | 0-3 | 4-6 | 7-10 | 11-16 | 17-21 | 22-27 | 28-33 | 33-40 | 41 and over |
|---|---|---|---|---|---|---|---|---|---|
| 50 | 407 | 202 | 199 | 59 | 17 | 17 | 17 | 17 | 17 |
| 60 | 368 | 194 | 129 | 55 | 44 | 27 | 25 | 23 | 23 |
| 70 | 263 | 256 | 127 | 44 | 33 | 33 | 33 | 33 | 33 |
| 80 | 345 | 171 | 106 | 32 | 21 | 4 | 2 | 0 | 0 |
| 90 | 153 | 191 | 196 | 119 | 11 | 5 | 5 | 5 | 5 |
| 100 | 236 | 120 | 86 | 13 | 0 | 0 | 0 | 0 | 0 |
| 110 | 320 | 230 | 84 | 10 | 0 | 0 | 0 | 0 | 0 |
| 120 | 287 | 230 | 145 | 45 | 13 | 0 | 0 | 0 | 0 |
| 130 | 415 | 210 | 129 | 86 | 33 | 12 | 0 | 0 | 0 |
| 140 | 457 | 508 | 142 | 76 | 25 | 12 | 8 | 0 | 0 |
| 150 | 524 | 277 | 143 | 30 | 0 | 0 | 0 | 0 | 0 |
| 160 | 390 | 185 | 182 | 42 | 0 | 0 | 0 | 0 | 0 |
| 170 | 148 | 186 | 191 | 114 | 6 | 0 | 0 | 0 | 0 |
| 180 | 131 | 299 | 151 | 190 | 12 | 4 | 0 | 0 | 0 |
| 190 | 405 | 200 | 197 | 57 | 15 | 15 | 15 | 15 | 15 |
| 200 | 515 | 243 | 213 | 26 | 13 | 13 | 13 | 13 | 13 |
| 210 | 177 | 332 | 210 | 67 | 15 | 1 | 0 | 0 | 0 |
| 220 | 667 | 347 | 236 | 93 | 62 | 47 | 41 | 45 | 41 |
| 230 | 286 | 210 | 123 | 74 | 31 | 1 | 0 | 0 | 0 |
| 240 | 85 | 202 | 198 | 106 | 35 | 0 | 0 | 0 | 0 |
| 250 | 190 | 238 | 178 | 98 | 21 | 11 | 11 | 11 | 11 |
| 260 | 461 | 512 | 146 | 80 | 29 | 16 | 12 | 4 | 4 |
| 270 | 236 | 221 | 141 | 94 | 29 | 0 | 0 | 0 | 0 |
| 280 | 436 | 231 | 150 | 107 | 54 | 33 | 21 | 21 | 21 |
| 290 | 198 | 227 | 185 | 77 | 8 | 0 | 0 | 0 | 0 |
| 300 | 548 | 301 | 167 | 54 | 24 | 24 | 24 | 24 | 24 |
| 310 | 26 | 117 | 107 | 50 | 8 | 0 | 0 | 0 | 0 |
| 320 | 98 | 215 | 211 | 119 | 48 | 13 | 13 | 13 | 13 |
| 330 | 269 | 153 | 119 | 46 | 33 | 33 | 33 | 33 | 33 |
| 340 | 289 | 195 | 99 | 22 | 0 | 0 | 0 | 0 | 0 |
| 350 | 129 | 269 | 128 | 38 | 0 | 0 | 0 | 0 | 0 |
| 360 | 295 | 201 | 105 | 28 | 6 | 6 | 6 | 6 | 6 |

# Problem 4

Collect the All-weather, IFR and VFR PRN files with summarized wind information for Ronald Reagan Airport (DCA) using the NOAA Integrated Surface Database available at https://airports-gis.faa.gov/windRose/. After loading the file in the Java wind rose tool answer the following questions. The critical aircraft flying into DCA is a Boeing 757-200.

a) Find the percent of the time, all-weather landing operations at DCA airport occur on runway 19 if a 5 knot tailwind component is allowed in the landing operations.

b) Find the percent of the time, all-weather landing operations at DCA airport occur on runway 1 if a 5 knot tailwind component is allowed in the landing operations.

c) Find the percent of coverage at the airport (all weather conditions) if runways 1-19 combined are used. Does the airport meet the FAA wind design criteria?

d) Find the percent of the time, IFR landing operations at DCA airport occur on runway 19 if 5 knot tailwind component is allowed in the landing operations. Is the answer very different compared to the result obtained in part (a)? Explain.

e) Under VFR weather conditions, find the percent of the time the wind is reported from 340 degrees and between 11-16 knots.

# Problem 3

This problem requires solving the runway orientation e problem using the old Wind Rose format shown below.

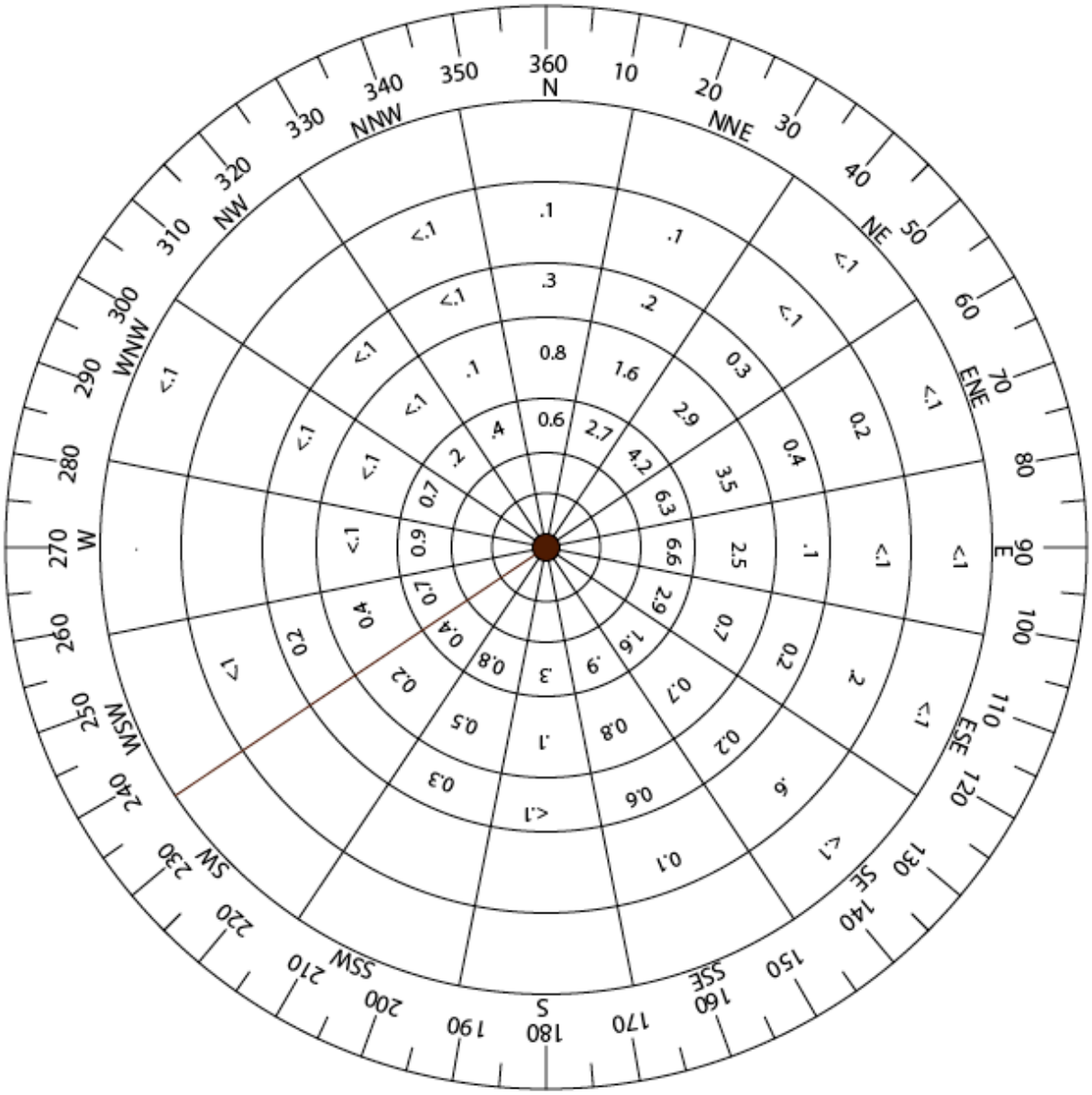


*Figure 1. Old Wind Rose format for a proposed airport in the Central America. Each Concentric Ring is 5 knots. The Dark Circle in the Middle is the Center of the Wind Rose. Values in Wind Rose are the Percent of Time the Wind Blows from the Given Azimuthal Direction and at a Given Speed.*

a) Find the ICAO critical crosswind component needed to design the runway orientation of the airport if the runway serves aircraft such as the Airbus A319. Use ICAO Wind Rose standards.

b) Determine the optimal orientation of the runway if this was a new airport site with the wind data provided.

c) Find the percent of the time that each runway end can be used if the the runway orientation you propose is built.