

## Assignment 4: Wind Rose Analysis

Date Due: June 30, 2016

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### Problem 1

A new airport location has been proposed and the airport would like to study the wind patterns. The airport is expected to receive commercial traffic with the Airbus A380-800 as the critical aircraft (see figure below). For this analysis use the FAA Java application for wind rose available at: <https://airports-gis.faa.gov/airportsgis/publicToolbox/windroseForm.jsp>. Wind data collected at the airport proposed site is shown in Table 1.



*Figure 1. Airbus A380-800 on Final Approach to Washington, Dulles international Airport (A. A. Trani).*

- For the proposed airport, find the design crosswind component according to ICAO criteria.
- 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 the resulting wind rose for the optimal solution indicating the coverage obtained using both runway thresholds.
- Find the percent of the time **each runway end** can be used if a 5-knot tailwind is allowed in the calculations.

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	510	420	134	23	0	0	0	0	0
20	320	220	169	91	34	14	0	0	0
30	560	540	400	178	40	20	5	0	0
40	534	400	230	78	11	0	0	0	0
50	632	520	240	59	17	17	17	17	17
60	418	230	120	55	44	16	14	4	2
70	635	760	540	210	120	80	33	20	13
80	634	490	320	190	45	43	14	18	2
90	569	453	198	234	36	30	12	5	3
100	539	620	540	250	47	36	20	10	2
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	117	67	16	5	4	1
200	515	243	213	26	13	13	13	13	7
210	432	319	213	78	24	1	0	0	0
220	667	347	236	93	62	47	41	12	3
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	12	0	5	0
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	6
290	198	227	185	77	8	0	0	0	0
300	548	301	167	54	24	16	12	5	3
310	258	127	107	50	8	0	0	0	0
320	98	215	211	119	48	13	8	0	0
330	269	153	119	46	30	13	5	4	2
340	289	195	99	22	0	0	0	0	0
350	238	128	128	38	0	0	0	0	0
360	267	201	105	28	9	3	1	0	0
Total	13901	11048	6974	3268	975	468	241	142	65

## Problem 2

Use the wind data provided in Table 2 to estimate the optimal runway orientation for a proposed **regional airport site in China**. The critical aircraft for the proposed airport is the Xian MA600 which has similar performance as the ATR-72 aircraft manufactured in France by Aerospatiale/Alenia. The aircraft has a typical takeoff distance requirement of 1,300 meters at MTOW and sea level conditions. The proposed regional airport will be located at sea level.

- Select the crosswind criteria for the design according to ICAO standards.
- Find the optimal runway orientation for the runway (or runways) for this airport using the wind data provided. 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 the resulting wind rose for the optimal solution indicating the coverage obtained using both runway thresholds.



*Figure 2. Aerospatiale/Alenia ATR-72 (left) and Xian MA-600 (right).*

Table 2. Wind Data for New Regional Airport in China. Speeds are Shown in knots 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	21	133	178	61	2	0	0	0	0
20	17	98	97	31	1	0	0	0	0
30	18	53	76	20	0	0	0	0	0
40	14	58	59	13	1	0	0	0	0
50	24	50	61	11	0	0	0	0	0
60	11	39	52	17	2	0	0	0	0
70	5	48	56	13	0	0	0	0	0
80	12	43	55	9	0	0	0	0	0
90	13	56	35	10	0	0	0	0	0
100	17	74	38	11	1	0	0	0	0
110	32	94	42	7	1	2	0	0	0
120	54	133	53	4	1	0	0	0	0
130	50	196	52	9	0	0	0	0	0
140	57	137	82	7	1	1	0	0	0
150	48	97	71	18	3	0	0	0	0
160	18	42	83	28	1	0	0	0	0
170	8	48	84	78	11	0	0	0	0
180	10	61	124	82	7	7	0	0	0
190	17	97	120	67	12	0	0	0	0
200	24	127	130	72	10	0	0	0	0
210	24	93	92	45	11	4	1	0	0
220	19	55	98	58	21	1	2	0	0
230	7	45	81	77	22	6	1	1	0
240	10	41	90	66	21	2	1	0	0
250	7	37	82	52	17	6	0	0	0
260	3	27	88	61	4	3	0	0	0
270	15	44	67	54	15	2	1	0	0
280	12	45	59	72	17	2	0	0	0
290	10	58	78	55	11	0	0	0	0
300	13	56	76	62	6	0	0	0	0
310	3	33	48	38	6	0	0	0	0
320	12	39	38	29	2	2	0	0	0
330	11	39	56	29	2	0	0	0	0
340	12	42	42	15	1	0	0	0	0
350	12	62	74	33	1	0	0	0	0
360	27	148	181	80	5	0	0	0	0
Total	21	133	178	61	2	0	0	0	0