NOAA Technical Memorandum NWS ER-71

WASHINGTON METROPOLITAN WIND STUDY 1981-1986

Clarence Burke, Jr. and Carl C. Ewald
CWSU, Leesburg, VA

Scientific Services Division
Eastern Region Headquarters
February 1987

U.S. DEPARTMENT OF COMMERCE / National Oceanic and Atmospheric Administration / National Weather Service

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TABLE OF CONTENTS

BACKGROUND

The importance of wind direction and speed in determining the operation runway caused this study. During the past five years from October 1, 1981, until October 7, 1986, almost 37,100 hourly wind observations from National (DCA), Dulles (IAD, Baltimore-Washingtion (BWI) and Andrews (ADW) airports were examined and 2013 observations or 5.4% of them which met one of the 3 criteria listed below were recorded.

This study is divided into a separate section for each criterion. Hopefully the results of this study represented by numerous tables will improve the operational wind forecasts for these airports made by the Leesburg CWSU Meteorologists at the beginning of every shift.

CRITERIA

The wind direction and speed for DCA, IAD, BWI, and ADW airports were recorded when one of the following three criteria were met:

(1) The wind direction at DCA differs from that at IAD, BWI or ADW by MORE than 70 degrees and the wind speed at one or more of the four airports is 7 knots or greater.

(2) The sustained wind speed at one airport differs from that at another airport by MORE than 8 knots.

(3) The wind gusts at one airport exceeds the sustained wind OR wind gusts at another airport by 10 knots or more.

CRITERION NUMBER ONE: DIRECTIONAL DIFFERENCES

QUESTIONS (TABLES):

1. What time do these observations occur? (Table #1)
2. What is their duration? (Table #2)
3. How often does it occur with calm winds? (Table #3)
4. How often does it occur in a stronger pressure gradient? (Table #4 and 5)
5. How often does each airport have the strongest wind? (Table #6)
6. How often do wind speeds at two airports differ by more than 10 knots? (Table #7)
7. What is the preferred wind direction at DCA, IAD and BWI when criterion #1 occurs? (Table #8 and 9)
8. What is the wind direction at the other airports when there is a river breeze at DCA and BWI airport? (Table #10 and 11)
9. How many times is the wind at DCA from a particular quadrant for each hour? (Table #12)
10. How often does the wind direction at each airport differ from the other three airports? (Table #13)
11. How often does criterion #1 occur with each of three common synoptic situations? (Table #14)

DISCUSSION:

Only 2% or 759 of all wind observations met criterion #1. The majority of these wind observations occur between 1500 and 2100 GMT (338 observations or 44.5%). More observations (120) occur during the evening rush hour than the morning rush (95).

Criterion #1 conditions occurred 128 times for two to three hours in a row. Only 26 cases were observed when criterion #1 wind conditions were met for 4 to 8 consecutive hours (Table #2). The majority of these consecutive observations last from 1600 to 1900/2000 GMT.

A large number of wind observations meeting criterion #1 shows that 8% of the observations had one or two airports reporting calm winds with ADW reporting the most (38) and BWI the least (5).

Considering occurrences during a stronger pressure gradient, tables #4, 5, and 6 show that BWI has the strongest sustained winds most often while ADW reported the least number of occurrences. Wind speeds/gusts exceeded 12 knots mostly when the wind direction was from the southwest, west or northwest and very seldom with a northerly, northeasterly or easterly wind. Table #7 shows that 95% of the time wind speeds are generally uniform (within 10 knots) when criterion #1 is met.

Table #8 shows a preponderance (42.3%) of observations meet criterion #1 when DCA has a wind direction of 140° to 190° (southeast to south). The least number of observations occur with a west-northwest direction because winds from that direction are usually stronger and uniform in direction thus not meeting criterion #1.

Table #9 shows a similar preponderance (41.8%) of observations meet criterion #1 when BWI has a wind direction from 240° to 290° (west-southwest through west-northwest) with a secondary maximum (14%) with a northeasterly to easterly (60° to 110°) wind direction. Dulles showed a more even distribution with the top three directions: 300° to 350° (26.4%), 180° to 230° (22%) and 240° to 290° (18.6%).

In addition to the proximity of DCA to the Potomac River, both BWI and IAD have nearby topographical features. Bull Run Mountain (1,339 feet high) is 15 miles west-southwest of IAD while the higher Blue Ridge Mountains (1,800 feet high) are located 25 to 30 miles northwest of the airport. In addition to these two mountains the Potomic River is about 13 to 15 miles northeast of IAD. An inlet off the Papasco River located 3 to 4 miles east-northest of BWI may provide a northeasterly to easterly river breeze there.

When the wind direction at DCA is from the southeast through southwest (58% of the time) the direction at the other three airports is illustrated by table #10. Note that ADW's wind direction is usually similar to DCA (seldom out of the north-northeast) due to its proximity (9-10 miles_ to DCA. Baltimore-Washington airport had mostly south-westerly to westerly winds when DCA had southerly winds but also a fair number of east-northeasterly winds due to the river breeze mentioned earlier. Dulles airport showed the most even distribution of wind directions and had the highest number of northwesterly winds. Since cold fronts pass IAD and sometimes BWI first, they have a northwesterly wind compared to southerly winds at DCA and ADW. Table #11 shows that when east-northeasterly winds occur at BWI, DCA has northwesterly direction and ADW an east-northwesterly wind also.

Table #12 shows a breakdown by hour of certain direction quadrants of DCA wind observations similar to table #1. Most of the observations occur between 1300 and 0100 GMT when the CWSU is open and when a river effect at DCA would be expected (note 1400-2000 GMT maximum in the 140°-190° direction column). Somewhat surprising is a secondary maximum in that direction column between 0500 and 0700 GMT. However with few airplanes flying then this maximum has little operational impact.

Table #13 explores how many times the wind direction at one airport is largely out of phase/synchronism with the other three airports. This included 674 observations when all four airports reported a wind direction and none were calm. Note that ADW was seldom in this category with only three cases (all involved southerly winds). Leading the pack with 81 cases, IAD had northwesterly winds after frontal passage as mentioned previously. Also IAD reported many easterly to southeasterly winds when the other airports had southwesterly to northerly winds. National airport was out of synchronism with the other airports having southerly to easterly winds during the river effect when the other airports had westerly winds. When the river effect produced east-northeasterly winds at BWI, the other airports reported a southerly to northwesterly wind direction.

Most of the observations that meet criterion #1, occur in a light pressure gradient and often involve a high pressure system or ridge in the Washington Metropolitan area. Table #14 shows the number of occurrences of criterion #1 with three common synoptic situations explained below.

Fronts or trofs present in our metropolitan area have no preference for a particular hour of the day or month of the year. They usually pass through our area from north to south so winds at IAD and sometimes BWI will change to the northwest first followed by a wind shift of southerly winds to the northwest at DCA and ADW later.

Most thunderstorms occur during the summer months and produce highly variable wind directions depending upon the location of the wind equipment to the outflow boundary of the cumulonimbus cloud.

The river effect at DCA occurs mainly between 1400 and 2000 GMT under sunny skies and light pressure gradient. It occurs almost twice as often during the afternoon (29 cases) than the morning (16). Winds at DCA are usually from 160° to 190° while the other airports report directions ranging from 240° to 300°.

<u>OPERATIONAL GUIDELINES</u> (When criterion #1 conditions are met)

1. Generally occurs in a light pressure gradient, ie. high or ridge in DC area.

2. Less common with winds from the west-northwest and east-southeast.

3. Occurs mostly between 1500 and 2200 GMT.

4. Generally lasts two hours or less.

5. Predominant directions:

   DCA southeast through southwest (58% of observations)

   BWI west-southwest through west-northwest (42% of observations)

6. River effect/breeze at DCA and BWI usually occurs with sunny skies and light winds.

7. During a DCA river breeze forecast these wind directions:

   IAD and BWI - southwest to west-northwest

   DCA - southeast to south

   ADW - south to southwest or calm

8. During a BWI river breeze forcast these wind directions:

   BWI and ADW - east-northeast

   DCA - south-southeast river breeze

   IAD - northwest

9. Forecast the strongest sustained wind speed at BWI followed by DCA.
10. Forecast uniform (less than 10KT difference) wind speeds.
11. Wind directions are variable in thunderstorms.
12. When one airport's wind direction is out of phase with the other three forecast these wind directions - If IAD: northwest after frontal/through passage east to southeast at other times, if BWI: east-northeast (river breeze), if DCA: south to southeast (river breeze).

TABLE #1

NUMBER OF OBSERVATIONS EACH HOUR THAT MET CRITERION #1

Time (GMT)	Number of Observations	Time (GMT)	Number of Observations	Time (GMT)	Number of Observations
01Z	25	09Z	19	17Z	58
02Z	19	10Z	18	18Z	47
03Z	14	11Z	26	19Z	44
04Z	24	12Z *	26	20Z	47
05Z	22	13Z *	32	21Z *	47
06Z	15	14Z *	37	22Z *	33
07Z	24	15Z	45	23Z *	40
08Z	15	16Z	50	24Z	32
				TOTAL	759

*RUSH HOUR

TABLE #2

NUMBER OF OBSERVATIONS THAT MET CRITERION #1
FOR 2 TO 8 CONSECUTIVE HOURS

Duration	2 HRS	3 HRS	4 HRS	5 HRS	6 HRS	7 HRS	8 HRS
Number of Obervations	93	35	17	7	2	1	1

156 OUT OF 759 OBSERVATIONS (20.6%)

TABLE #3

NUMBER OF TIMES CALM WINDS WERE OBSERVED
DURING CRITERION #1

CALM WINDS AT ONE AIRPORT - 53 OBSERVATIONS

CALM WINDS AT IAD AND ADW ON SAME HOUR - 7 OBSERVATIONS

AIRPORT	IAD	BWI	ADW
Number of times calm winds occured	27	5	38

TABLE #4

NUMBER OF TIMES SUSTAINED WINDS AND/OR GUSTS EXCEEDED 12 KNOTS

AIRPORT	DCA	IAD	BWI	ADW	TOTAL
Number of Occurrences	26(3) *	34(6) *	46(2) *	14(2) *	120(13)

DIRECTION	N	NE	E	SE	S	SW	W	NW	TOTAL
Number of Occurrences	7	1	2	16	14	24	25	31	120

Number of hourly observations: 93(8) * Out of 759 12.3%
Sustained winds and/or gusts were 15 KTS or more on 53 observations
(Number of occurrences associated with thunderstorms) *

TABLE #5

NUMBER OF TIMES SUSTAINED WIND SPEEDS EXCEEDED 10 KNOTS AT 1, 2, 3, AND ALL 4 AIRPORTS

NUMBER OF AIRPORTS	ONE	TWO	THREE	FOUR	TOTAL
NUMBER OF OBSERVATIONS	108	33	14	4	158 (20.8%)

TABLE #6

AIRPORT WITH THE STRONGEST SUSTAINED WINDS

AIRPORT	DCA	IAD	BWI	ADW	TIES	TOTAL
Number of Occurrences	231	116	274	40	98	759
Percentage of Total	30.4%	15.3%	36.1%	5.3%	12.9%	100%

TABLE #7

NUMBER OF TIMES SUSTAINED WIND SPEED AT ONE AIRPORT
DIFFERED FROM ANOTHER AIRPORT BY 10 KNOTS OR MORE

AIRPORTS	NUMBER OF OCCURRENCES	AIRPORTS	NUMBER OF OCCURRENCES
DCA-BWI	8	IAD-ADW	9
DCA-IAD	5	BWI-ADW	4
DCA-ADW	3	BWI-Other Three	6
IAD-BWI	6		

SPEED DIFFERENCE	10 KNOTS OR MORE	15 KNOTS	20 KNOTS	TOTAL
NUMBER OF OBSERVATIONS	33	2	1 (In a thunderstorm)	36 (5.1%)

TABLE #8

WIND DIRECTION AT DCA WHEN CRITERION #1 OCCURRED

DIRECTION	NUMBER OF OBSERVATIONS
0°-60°	98
70°-130°	70
140°-190°	324
200°-250°	114
260°-300°	51
310°-350°	109
TOTAL	759

TABLE #9

WIND DIRECTION AT IAD AND BWI WHEN CRITERION #1 OCCURRED

DIRECTION	IAD	BWI
0°-50°	87	64
60°-110°	58	105
120°-170°	94	75
180°-230°	159	89
240°-290°	135	324
300°-350°	191	94
	TOTAL 724	TOTAL 746

TABLE #10

WIND DIRECTION AT IAD, BWI AND ADW WHEN
WIND DIRECTION AT DCA IS 140° THROUGH 250°

	NUMBER OF OBSERVATIONS AT EACH AIRPORT		
DIRECTION	IAD	BWI	ADW
0°-60°	24	27	6
70°-130°	28	39	33
140°-200	117	52	82
210°-280°	136	234	255
290°-350°	115	79	30
CALM	18	3	16
TOTAL	438	434	422

TABLE #11

WIND DIRECTION AT DCA, IAD AND ADW WHEN
WIND DIRECTION AT BWI IS 60° THROUGH 130°

	NUMBER OF OBSERVATIONS AT EACH AIRPORT		
DIRECTION	DCA	IAD	ADW
0°-60°	29	27	24
70°-130°	22	16	42
140°-200°	37	27	19
210°-280°	8	12	13
290°-350°	30	40	11
CALM	0	3	9
TOTAL	126	125	118

TABLE #12

HOURLY BREAKDOWN OF WHEN CERTAIN WIND DIRECTIONS OCCUR AT DCA

HOUR (GMT)	DIRECTION 0°-60°	140°-190°	200°-250°	310°-350°
01	3	2	7	7
02	3	6	4	2
03	2	3	3	3
04	3	7	6	5
05	2	12	3	3
06	3	8	1	2
07	1	10	3	6
08	0	4	6	5
09	1	5	5	5
10	2	9	2	3
11	4	12	5	4
12	1	13	4	2
13	5	13	7	3
14	4	21	1	6
15	5	24	6	4
16	7	25	3	6
17	8	35	2	2
18	7	22	7	2
19	8	22	5	3
20	8	23	5	4
21	8	17	6	5
22	6	7	7	6
23	3	15	10	6
24	4	9	6	8
TOTAL	98	324	114	102

TABLE #13

NUMBER OF TIMES WIND DIRECTION AT ONE
AIRPORT IS MORE THAN 90° DIFFERENT THAN
THE DIRECTION OF THE OTHER 3 AIRPORTS
WHEN THEY ARE WITHIN 30°-40° OF EACH OTHER

AIRPORT	DCA	IAD	BWI	ADW
Number of Observations	41	81	54	3

179 OBSERVATIONS OUT OF 674 (26.6%)

EXCLUDED HOURLY OBSERVATIONS IF AN AIRPORT'S WIND REPORT WAS MISSING (35 CASES) OR CALM WINDS WERE OBSERVED (60 CASES).

TABLE #14

THREE COMMON SYNOPTIC SITUATIONS
WHEN CRITERION #1 OCCURRED

SITUATION	NUMBER OF DAYS	NUMBER OF OCCURRENCES	PERCENTAGE OF OBSERVATIONS
FRONT/TROUGH IN AREA	65	87	
THUNDERSTORMS IN AREA	32	57	
RIVER EFFECT AT DCA	53 *	154	
TOTAL	150	298	39.3%

* 29 DAYS DURING AFTERNOON, 16 DAYS DURING MORNING, 5 DAYS BOTH AND 3 DAYS AROUND NOON.

CRITERION NUMBER TWO: SPEED DIFFERENCES

QUESTIONS (TABLES):

1. What time do these observations occur? (Table #15)
2. What is their duration? (Table #16)
3. What pair of airports has the greatest speed difference? (Table #17)
4. How often does each airport have the strongest winds? (Table #18)
5. How often does each airport have the lightest winds? (Table #18)
6. What is the wind direction at each airport? (Table #19)
7. How often are winds calm at each airport? (Table 19)
8. How often are wind gusts reported at each airport? (Table #20)
9. How often are there winds gust at one, three or all four airports? (Table #21)
10. How often are wind speeds in various 5 knot speed intervals? (Tables #22 and 23)

DISCUSSION:

The 272 observations which met criterion #2 occurred in two common synoptic situations. A weaker pressure gradient with light/calm winds at IAD and ADW and 10 to 15 knot winds at DCA or BWI usually occurs when a cold front is located near the coast or just west of the mountains. Criterion #2 conditions also occur in a strong pressure gradient frequently with gusts reported at ADW and DCA. Often the strong gradient arises when a large high pressure system or ridge is located well off the coast in the western Atlantic Ocean or over the Midwest and strong low exists over the Northeast.

Winds meeting this criterion were mostly observed at night between 0000 and 0100 GMT as well as between 0500 and 0700 GMT with an isolated maximum at 1000 GMT. It occurred less often during the afternoon between 1800 and 2300 GMT when wind speeds are more uniform. (See Table #15). It seldom lasted over two consecutive hours (Table #16) except in the strong pressure gradient on January 21, 1985, when this criterion occurred for 5 consecutive hours between 1300 and 1700 GMT.

The following pair of airports: DCA and IAD reported the greatest speed difference twice as often as the other five airport pairs (Table #17). The reason for this difference is reflected in Table #18 where DCA had the strongest winds most often while IAD frequently reported the weakest sustained wind speed.

Table #19 indicates several interesting findings, BWI exceeds the other airports in the number of cases with a 40° to 70° and 280° to 310° wind direction, but had only half as many north-northwest (320°-350°) winds observed. DCA led the other airports in winds from 160° to 190° due to the river effect and had only two calm wind reports. IAD on the other hand led the other airports with twenty-seven observations of calm winds. Andrews AFB lead the airports in number of observations from a 200° to 230° direction and was second to IAD with seventeen reports of calm winds.

Fifty-two percent (142) of the observations in this criterion contained wind gusts. Very seldom were ADW and DCA the only airport NOT reporting a gust (see Table #21) because ADW and DCA reported the largest number of observations having a wind gust (Table #20).

Stratifying the observations by wind speed intervals of 5 knots (Table #22), reveals that the majority of reports in the 11 to 15 knot speed range occurred at DCA and BWI with IAD reporting the fewest number. DCA also led in the 16 to 20 knot range with IAD and ADW reporting only half as many reports as DCA. The 21 to 25 knot range shows BWI in the lead followed by IAD with ADW only reporting half as many cases as BWI.

On the other side of the coin, all four airports has wind speeds less than or equal to 10 knots on 20 observations and eight additional observations had wind speeds equal to or less than 11 knots. (Table #23).

OPERATIONAL GUIDELINES: (When criterion #2 conditions are met)

1. Seldom occurs between 1800 and 2300 GMT.
2. Does not occur for over 2 consecutive hours.
3. Winds at BWI are not usually from the north-northwest.
4. Calm winds occur most often at IAD and ADW and seldom at DCA.
5. Strongest winds occur at DCA followed by BWI.
6. Lightest winds occur at IAD followed by ADW.
7. Greatest wind speed difference occurs most frequently between DCA and IAD airports.
8. Forecast west-northwest wind direction at BWI and north-northwest at the other airports.
9. Look for south-southeast wind direction at DCA and south-southwest at ADW.
10. Wind gusts occur half the time.
11. Greatest number of wind gusts occur at ADW and DCA.

TABLE #15

NUMBER OF OBSERVATIONS EACH HOUR MEETING CRITERIONS #2

HOUR	NUMBER OF OBS	HOUR	NUMBER OF OBS
01Z	15	13Z	8
02Z	12	14Z	13
03Z	10	15Z	12
04Z	8	16Z	11
05Z	16	17Z	11
06Z	15	18Z	8
07Z	15	19Z	7
08Z	10	20Z	11
09Z	11	21Z	7
10Z	17	22Z	8
11Z	13	23Z	6
12Z	12	24Z	16
		TOTAL	272

TABLE #16

NUMBER OF OBSERVATIONS THAT MET CRITERION #2 FOR 2 TO 5 CONSECUTIVE HOURS

DURATION	NUMBER OF OBSERVATIONS
2 HOURS	18
3. HOURS	7
4 HOURS	1
5 HOURS	1

TABLE #17

NUMBER OF TIMES A PAIR OF AIRPORTS HAD THE GREATEST SPEED DIFFERENCE

PAIR OF AIRPORTS		NUMBER OF OBSERVATIONS
DCA-IAD		80
DCA-BWI		39
DCA-ADW		35
IAD-BWI		43
IAD-ADW		41
BWI-ADW		34
	TOTAL	272

TABLE #18

NUMBER OF TIMES EACH AIRPORT HAD THE HIGHEST AND LOWEST SUSTAINED WIND SPEED

	DCA	IAD	BWI	ADW	TIE	TOTAL
HIGHEST	121	43	79	22	7	272
LOWEST	22	119	35	77	19	272

TABLE #19

WIND DIRECTION AT EACH AIRPORT WHEN CRITERION #2 WINDS OCCURRED

	DCA	IAD	BWI	ADW
0-30	23	21	23	20
40-70	9	11	18	8
80-110	5	8	6	5
120-150	3	7	4	2
160-190	39	29	25	18
200-230	22	23	19	36
240-270	20	7	27	20
280-310	59	58	105	70
320-350	79	79	38	73
CALM	2	27	7	17

TABLE #20

NUMBER OF TIMES WIND GUSTS WERE

REPORTED AT EACH AIRPORT

	DCA	IAD	BWI	ADW
Number of Observations	83	64	59	90

TABLE #21

NUMBER OF TIMES EACH AIRPORT WAS THE ONLY
ONE REPORTING/NOT REPORTING A WIND GUST

	DCA	IAD	BWI	ADW
With Gust	15	11	13	19
Without Gust	4	12	14	1

On 15 observations all four airports reported gusts. 142 observations (52%) had one or more airports reporting a wind gust.

TABLE #22

NUMBER OF TIMES EACH AIRPORT REPORTED A SUSTAINED
WIND OVER 10 KNOTS FOR EACH 5 KNOTS SPEED INTERVAL

WIND SPEED	DCA	IAD	BWI	ADW
11-15 KNOTS	108	46	86	68
16-20 KNOTS	62	26	51	28
21-25 KNOTS	13	15	17	9
26-30 KNOTS	4	3	1	1
TOTAL	187	90	155	106

TABLE #23

NUMBER OF TIMES ONE, TWO, THREE OR ALL FOUR
AIRPORTS REPORTED A SUSTAINED WIND IN
EACH SPEED INTERVAL

NUMBER OF AIRPORTS	11-25 KNOTS	16-20 KNOTS	21-25 KNOTS	25-30 KNOTS
ONE	146	107	32	9
TWO	63	28	9	0
THREE	12	4	1	0

On 20 observations all four airports had wind speeds less that or equal to 10 KTS.
Wind speeds at all four airports were equal to or less than 11 Knots 28 times.

CRITERION NUMBER THREE: GUST DIFFERENCES

QUESTIONS (TABLES):

1. What time do these observations occur? (Table #24)
2. What is the wind direction when criterion #3 occurs? (Table #25)
3. How often does each airport report the highest sustained wind? (Table #26)
4. How often does each airport report the maximum wind gusts? (Table #2
5. How often does each airport report a maximum wind gusts from a given direction? (Table 27)
6. How often does each airport report a wind gusts for each 10 knots speed range? (Table #28)
7. How often does only one airport report a wind gust? (Table #29)
8. How often is one airport the only one NOT reporting a wind gust? (Table #30)
9. How often are the winds fairly strong and meet criterion #3? (Table #31)

DISCUSSION:

Almost all of the 982 observations meeting criterion #3 occur in a strong pressure gradient with a low pressure system over the Northeastern United States and a high pressure system in the Midwest.

Looking at Table #24, the greatest number of wind observations meet criterion #3 between 1400 and 2100 GMT during the time of maximum solar heating. A corresponding minimum occurs at 0300, 0500 and 0600 GMT.

Stratifying observations by 30 degree intervals of wind direction (Table #25); the wind is from 300° to 330° almost half the time. Over one-fifth of the time winds are from the west-northwest (260° to 290°). Wind reports meeting criterion #3 rarely occur when the wind direction is between 60° and 170°.

Despite their close proximity, Table #26 indicates that DCA reports the highest sustained winds and the maximum gusts twice as often as ADW. In maximum gusts IAD and DCA are tied but in highest sustained winds DCA exceeds BWI and IAD by a moderate margin.

Considering wind direction, Table #27 shows that DCA exceeds the other three airports with the largest number of maximum gusts from the west-northwest and the south-southwest. BWI slightly exceeds DCA in maximum gusts from the north-northeast while IAD greatly exceeds the other three airports in reporting east-southeast maximum wind gusts.

Most of the wind gusts meeting this criterion fall in the 20 to 30 knots range. The greatest variance in the number of observations shown in Table #28 fall in the 10 to 19 knot range with DCA and ADW tied for the highest number (107) and BWI reporting the fewest occurrences (24).

Over two-thirds of the times when only one airport reported a wind gust it was DCA and IAD. Very rarely (13% of the time) was ADW the only airport reporting a gust. On the other hand Table #30 shows that BWI was the only airport NOT reporting a wind gust in 44% of the cases.

Reviewing Table #31, IAD and DCA reported sustained winds greater than or equal to 15 knots and wind gusts greater than or equal to 25 knots in almost one half of their observations that met criterion #3.

OPERATIONAL GUIDELINES (When criterions #3 conditions are met)

1. Occurs most often between 1400 and 1900 GMT.
2. Occurs mostly with west-northwest winds.
3. Rarely occurs with a northeast-southeast wind direction.
4. Highest sustained winds occur at DCA followed by BWI and IAD.
5. Maximum gusts occur at IAD and DCA followed by BWI.
6. Highest wind or maximum gusts RARELY occur at ADW.
7. Usually occurs when gusts are in the 20 to 30 knot range.
8. Maximum wind gust occurs at IAD with strong winds out of the east-southeast.
9. Often BWI does NOT have wind gusts when the other three airports do.
10. Rarely is ADW the only airport reporting a gust.

TABLE #24

NUMBER OF OBSERVATIONS EACH HOUR THAT
MET CRITERION #3

HOUR (GMT)	NUMBER OF OBSERVATIONS	HOUR (GMT)	NUMBER OF OBSERVATIONS
01	29	13	44
02	22	14	65
03	16	15	64
04	23	16	66
05	17	17	73
06	17	18	68
07	20	19	61
08	20	20	59
09	27	21	60
10	34	22	43
11	30	23	33
12	56	24	35
		TOTAL	982

TABLE #25

NUMBER OF HOURLY WIND GUST OBSERVATIONS
UNDER CRITERION 3 FOR EACH 30 DEGREE
INTERVAL OF WIND DIRECTION

DIRECTION	NUMBER OF OBSERVATIONS (PERCENTAGE)
20-50	30 (3%)
60-90	20 (2%)
100-130	10 (1%)
140-170	19 (2%)
180-210	117 (12%)
220-250	35 (3.5%)
260-290	205 (21%)
300-330	457 (46.5%)
340-10	89 (9%)
TOTAL	982 (100%)

TABLE #26

NUMBER OF TIMES EACH AIRPORT REPORTED
THE HIGHEST SUSTAINED WIND AND
MAXIMUM GUST

STATION	HIGHEST SUSTAINED WIND	MAXIMUM GUST
DCA	279 (28%)	297 (30%)
IAD	205 (21%)	286 (29%)
BWI	208 (21%)	214 (22%)
ADW	123 (13%)	135 (14%)
TIES	167 (17%)	50 (5%)
TOTAL	982	982

TABLE #27

NUMBER OF TIMES ONE AIRPORT REPORTED
MAXIMUM GUST FROM A GIVEN DIRECTION

AIRPORT	N to NE	N to NW	S to SW	E to SE
DCA	20 (30.3%)	238 (33.4%)	65 (41.4%)	9 (19.6%)
IAD	18 (27.3%)	228 (32%)	42 (26.8%)	22 (48%)
BWI	24 (36.4%)	162 (22.7%)	25 (15.9%)	9 (19.6%)
ADW	5 (7.6%)	102 (14.3%)	25 (15.9%)	8 (17.4%)
	66	713	157	46

TABLE #28

NUMBER OF TIMES EACH AIRPORT REPORTED A
WIND GUST FOR EACH 10KT SPEED INTERVAL

WIND GUSTS SPEED	DCA	IAD	BWI	ADW	TOTAL
10 to 19KTS	107	55	24	107	
20 to 30KTS	420	410	306	339	-
31 to 4KTS	44	48	41	35	
OVER 40KTS	3	2	4	0	
ALL WIND GUSTS	574 (58%)	515 (52%)	375 (38%)	481 (49%)	982

TABLE #29

OBSERVATIONS MEETING CRITERION 3 WHEN ONLY ONE AIRPORT REPORTED A GUST

AIRPORT	DCA	IAD	BWI	ADW
Number of Occurrences (percent)	139(37%)	116(31%)	73(19%)	50(13%)

TABLE #30

NUMBER OF TIMES ONE AIRPORT WAS THE ONLY AIRPORT NOT REPORTING A WIND GUST

AIRPORT	DCA	IAD	BWI	ADW
Number of Occurrences (percent)	59(21%)	57(21%)	120(44%)	38(14%)

TABLE #31

NUMBER OF TIMES EACH AIRPORT REPORTED SUSTAINED WINDS EQUAL TO OR GREATER THAN 15KT AND WIND GUST EQUAL TO OR GREATER THAN 25KTS

DCA 179 (47%)	IAD 189 (49%)
BWI 153 (40%)	ADW 134 (35%)

ACKNOWLEDGEMENTS

We wish to thank our meteorologist-in-charge, Norbert W. Novocin and our fellow meteorologists Ronald P. Gilliand and John C. Marscher for their support and assistance in recording wind observations at the four airports.

We also are grateful for the support given by Wayne Bevan and Ronald Haggerty, our Traffic Management Unit Chief. A special thanks also to Claudia Ward for her excellent job typing this wind study.