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NO. 3

EQUIVALENT WINDS FOR NORTH AMERICAN AIR ROUTES
at heights of 5000, 10,000, 15,000, 20,000, 30,000,
40,000 and 53,000 feet

127240

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JULY 1962

BOEING
TRANSPORT DIVISION

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EQUIVALENT WINDS FOR NORTH AMERICAN AIR ROUTES

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30,000, 40,000 and 53,000 feet**

REVIEWS IN GEOPHYSICS NO. 3

By

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ABSTRACT

Equivalent headwinds or equivalent winds are computed using Sawyer's method for about 2000 routes over strategic air routes. The seasonal mean equivalent wind and its standard deviation and the annual 50-, 75- and 85-per cent reliability equivalent winds are tabulated. Route winds are computed for the 20,000-, 30,000-, 40,000- and 53,000-foot levels. An IBM 7090 program was used to compute the equivalent winds. Input data for the program consist, for each level, of a grid composed of the mean vector wind and the standard vector deviation at the intersection of each 5° of latitude with each 10° of longitude between 60°S and 60°N and at the intersection of each 5° of latitude with each 20° of longitude south and north of 60°S and 60°N respectively. In addition to the equivalent winds, great circle distances are computed and tabulated for each route.

FORWARD

Two years ago, The Boeing Company published three documents on equivalent route winds for domestic, international and military air routes for use in the airline industry. Since that time new and revised summaries of upper wind statistics were published. Boeing meteorologists incorporated these summaries into three new and completely revised and expanded documents on equivalent route winds. The new documents are "Equivalent Winds For North American Air Routes," D6-9176; "Equivalent Winds For World Air Routes," D6-9177; and "Great Circle Equivalent Route Winds For Military Application," D6-9175. These documents replace the three earlier "Wind Documents", "Winds For United States Air Routes," D6-5186; "Winds For World Air Route," D6-5187; and "Great Circle Route Equivalent Headwinds For Military Application," D6-5185.

The efforts of E. Lesford of the Engineering Computing and Analysis Staff for preparing the 7090 program used to compute the route winds is gratefully acknowledged. Thanks are also due to Alice Post for the industry and care shown in tabulating the wind data summaries.

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EQUIVALENT WINDS FOR NORTH AMERICAN AIR ROUTES

at heights of 5000, 10,000, 15,000, 20,000,
30,000, 40,000 and 53,000 feet

I. INTRODUCTION

The development and introduction of high-performance jet aircraft for civil and military use established a requirement for route wind statistics with which to make long-term estimates of the economic and strategic capabilities of these aircraft when operated at new cruising heights and over new route systems. To meet this need for route-wind data, Boeing Meteorologists computed seasonal and annual equivalent winds for the principal strategic air routes.

II. DEFINITIONS

A. EQUIVALENT ROUTE WIND

The equivalent wind for an air route may be defined as a uniform wind, which, directed along the track at all points, results in the same average ground speed as that actually attained. Alternately, the equivalent route wind is the difference between the average airspeed and the average ground-speed throughout the flight.

B. RELIABILITY EQUIVALENT ROUTE WIND

The reliability equivalent wind is in the case of a headwind (tailwind), a route wind which is not exceeded (a route wind which can be relied upon) a given per cent of occasions or time during a given period.

III. COMPUTATIONS

A. EQUATIONS

1. Equivalent Route Wind

Sawyer's theory of equivalent headwinds has been applied extensively to the computation of equivalent route winds¹⁻⁹. This method involves use of the mean vector wind and the standard vector deviation: two parameters which completely define the circular normal distribution of winds generally found in the free atmosphere. Charts and tabulations of the mean vector wind and the standard vector deviation are available in many meteorological publications¹⁰⁻¹⁹.

The principal assumptions of Sawyer's theory are (1) the wind speed does not exceed the speed of the aircraft and (2) the distribution of winds in the free atmosphere during a given season can be approximated by the circular normal distribution. Based on these and other assumptions, the basic equation for the average equivalent headwind, $\bar{w}$, over a route and expressed in terms of the mean vector wind, $\bar{V}$, and the standard vector deviation, σ , at points along the route is

$$\left[\bar{w} \right] = - \left[\bar{u} \right] + \frac{1}{A} \left\{ \left[\frac{(\bar{V})^2}{2} \right] + \left[\frac{\sigma^2}{4} \right] \right\} \quad (1)$$

where:

$\bar{u}$ = Mean wind parallel to the track

$\bar{v}$ = Mean wind normal to the track

σ = Standard vector deviation

A = Airspeed.

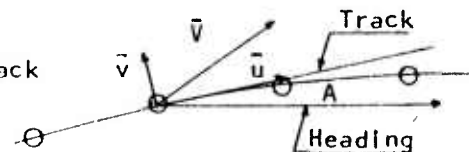


Fig. 1. Airspeed - Wind Vector Relationships

The bar denotes a mean value over a long period of time and the square brackets denote a mean value taken over a number of points along the route (Fig. 1).

Correlation studies and physical considerations reveal that vector winds at points along a route are related to one another^{1,21}. For this reason, the mean vector wind and the standard vector deviation at points along a route while sufficient to determine the average value of the route equivalent wind, are insufficient to determine its variability. For example, strong winds at points along a route may or may not occur simultaneously. If they do not occur together, there is a tendency for the headwind components to average out such that the average value of the extreme winds is less than the values of the extreme winds at individual points over the route. Sawyer¹ has shown this to be the case.

2. Route Standard Deviation

The route standard deviation provides a measure of the variability of the equivalent route wind. The relationship between the route standard deviation and the average value of the standard vector deviation at points along the route is

$$\sigma_t = s \left[\sigma^2 \right]^{1/2} \quad (2)$$

where:

- σ_t = Route standard deviation (tabulated value)
- s = Factor to convert the mean standard vector deviation of wind over a route, $\left[\sigma^2 \right]^{1/2}$, into the route standard deviation of the equivalent route wind. The value of s decreases with increasing route length and exhibits some variation with season, latitude and route orientation¹.

The values of s used in preparing Table 4 are those listed in Graystone⁶.

3. Great Circle Distance

Route lengths in nautical miles are computed over the great-circle course, i.e. the least distance on a sphere, between terminals. The expression used to compute great circle distances is

$$D = 60 \cos^{-1} \left\{ \sin \psi_1 \sin \psi_2 + \cos \psi_1 \cos \psi_2 \cos (\lambda_1 - \lambda_2) \right\} \quad (3)$$

where:

D = Great circle distance in nautical miles

ψ = Latitude

λ = Longitude

$\cos^{-1} \left\{ \right\}$ = Angle expressed in minutes.

South latitudes and east longitudes are considered negative and north latitudes and west longitudes are considered positive.

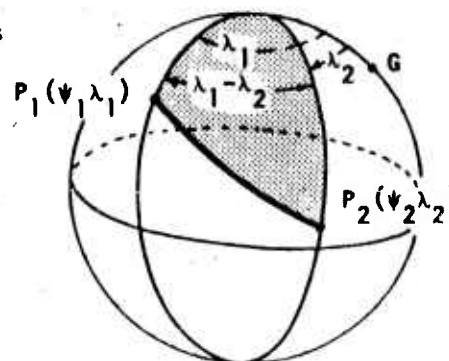


Fig. 2
Great Circle Distance

B. ANNUAL EQUIVALENT ROUTE WINDS

Annual equivalent route winds are computed from the mean seasonal values of equivalent route winds and their standard deviations. The technique involves an iterative procedure by which wind speeds are found such that 50, 75 and 85 per cent of the total area under the four seasonal wind distribution curves, lies to their right. With reference to Figure 3, the 50, 75 and 85 annual equivalent winds are estimated to be -5, -11 and -13 knots respectively.

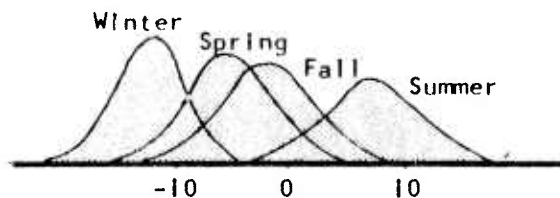


Fig. 3. Hypothetical Seasonal Wind Distribution

C. INPUT DATA

The most recent and internally consistent summaries of statistical wind data available were used. Wind statistics were obtained from Tucker¹⁷ and Heastie and Stephenson¹⁸ for the southern hemisphere and from Crutcher¹⁵ for the northern hemisphere, while the airport coordinates were obtained from standard reference sources. The mean vector wind and the standard vector deviation together with the coordinates of each terminal form the input data for an IBM 7090 program. The wind parameters for the four seasons and for the 5000-(850 mb), 10,000-(700 mb), 15,000-, 20,000-(500 mb), 30,000-(300 mb), 40,000-(200 mb) and 53,000-(100 mb) foot levels, were obtained by computing them at the intersection of each 5° of latitude with each 10° of longitude between 60°N and 60°S and at the intersection of each 5° of latitude with each 20° of longitude north of 60°N and south of 60°S.

D. METHOD

Equivalent route winds are computed by first dividing the route into an integral number of segments of 200 miles or less in length and then calculating the headwind at the mid point of these segments. This is accomplished by weighing the four nearest wind values (at grid points) in proportion to their proximity to the point on the route and then averaging. The averaged values in turn are used to compute the equivalent wind for the entire route.

By convention a positive sign denotes a tailwind, a negative sign a headwind.

E. TABULATIONS

Equivalent winds for over 1300 airline routes between 300 airports in North America including Hawaii, Bermuda and Puerto Rico are computed

(Tables 3 and 4). Table 3 contains equivalent winds for the 5000-, 10,000- and 15,000-foot levels for route lengths less than 400 nautical miles and in Table 4 are listed equivalent winds for the 20,000-, 30,000-, 40,000- and 53,000-foot levels for route lengths greater than 200 nautical miles. The route wind tabulations are organized alphabetically by the terminals identifying each route. Each route is further listed under both of its terminals in the index (Table 6). The tabulations consist of:

1. The direct and return seasonal mean equivalent route wind and its standard deviation and the annual 50-, 75- and 85-per cent reliability equivalent route wind in knots
2. The great circle distance in nautical miles.

An alphabetical listing of terminals with their airport names, geographical coordinates and length of longest runway is also provided (Table 5).

IV. USE OF TABLES

A. NORMAL CURVE

Brooks¹⁰ et al found that in any one season the distribution of equivalent route winds about the mean closely approximates the normal law of errors. According to this law, the mean and its standard deviation completely define the distribution of winds about the mean. In turn, this error distribution very nearly approximates the normal or Gaussian frequency distribution defined as

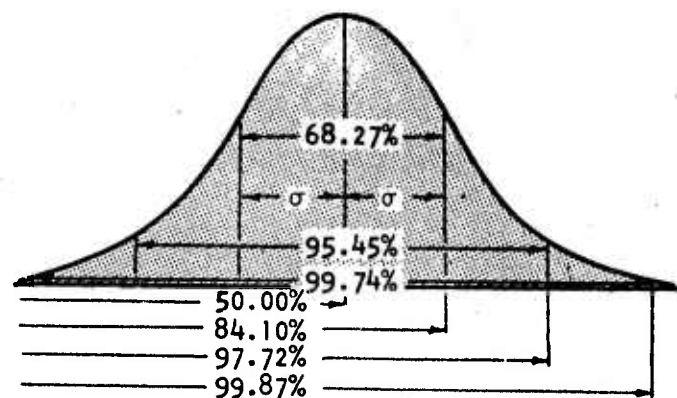
$$y = \frac{1}{\sigma\sqrt{2\pi}} e^{-x^2/2\sigma^2} \quad (4)$$

where:

y = The frequency ordinate at distance x from the mean
 σ = The standard deviation.

With reference to Figure 4, some of the more important properties of the normal curve to be noted in estimating reliability winds are:

1. The mean, median and mode are identical
2. Areas under the normal curve between abscissae $\pm \sigma$, $\pm 2\sigma$ and $\pm 3\sigma$ contain 68.27, 95.45 and 99.74 per cent of the whole sample
3. The value of the standard deviation equals the difference between the ordinate for 50 and 84.13 per cent, i.e. $50 + 68/2 = 84$ per cent.



a

B. ESTIMATING RELIABILITY EQUIVALENT ROUTE WINDS

Computation of reliability equivalent route winds deserves special attention since deviations of the relative frequency of extreme wind speeds from the assumed normal law of errors may be appreciable, particularly at levels and in regions affected by jet streams. The frequency of extreme values is probably higher than that predicted from the assumed model. For this reason reliability

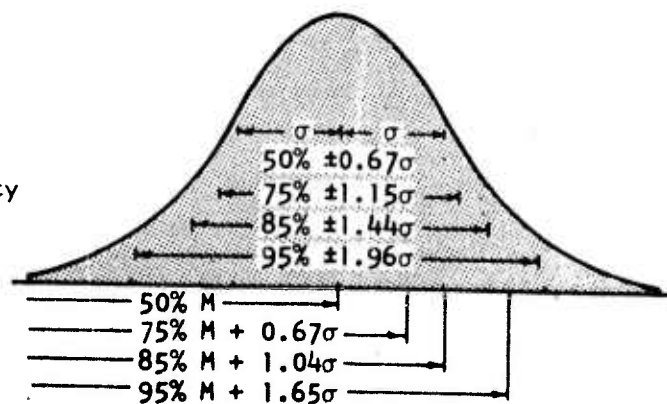


Fig. 4 b. Normal Curve

equivalent winds for percentages less than 5 and greater than 95 are likely unreliable.

Two methods for estimating equivalent winds for reliabilities other than for the tabulated mean values involve use of error factors and secondly, use of arithmetic probability paper.

1. Error Factor Method

For a given route, reliability equivalent winds are computed by subtracting the product of k times the standard deviation from the mean equivalent wind, where k is a factor derivable from the error function.

Values of k are given in Table 1.

Table 1. Error Factors

<u>Per Cent</u>	<u>k</u>
50	0.0
60	0.25
70	0.52
80	0.84
85	1.04
90	1.28
95	1.65

The error factors method is illustrated by computing the 85-per cent reliability equivalent route wind over the great circle New York-to-San Francisco route during winter at the 40,000-foot level.

From Table 4 the Direct and Return equivalent winds are -61 and 59 knots respectively and the standard deviation, 17 knots. From Table 1, the error factor is 1.04.

- a) The DIRECT 85-per cent reliability equivalent wind which should not be exceeded on 85 per cent of occasions is a headwind of -79 knots;

$$-61 - (1.04 \times 17) = -79 \text{ knots.}$$

- b) The RETURN 85-per cent reliability equivalent wind which can be relied on 85 per cent of occasions is a tailwind of 41 knots;

$$59 - (1.04 \times 17) = 41 \text{ knots.}$$

2. Arithmetic Probability Paper Method

As previously stated, in any one season the distribution of equivalent route winds about the mean closely approximates the normal law of errors and the normal or Gaussian frequency distribution defined in (4). Arithmetic probability paper is arranged with the per cent cumulative frequency scale printed on the ordinate such that the integral

$$Q(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-x^2/2} dx \quad (5)$$

of the normal frequency curve plots as a straight line while the abscissa has a linear scale. The sign convention for equivalent wind speeds is + for a tailwind and - for a headwind.

Thus, to obtain a frequency distribution of the equivalent route winds for the great circle New York-to-San Francisco route at 40,000 feet during winter, look up the value of the 50 per cent direct (-61 knots) and return (59 knots) equivalent wind and the standard deviation (17 knots) in Table 4. Next plot -61 on the 50 per cent value of the ordinate scale and -78 (-61 - 17) knots on the 84 per cent ordinate value and draw a straight line through these points. Similarly for the San Francisco-to-New York route, plot 59 knots on the 50 per cent ordinate value and 42 (59 - 17) knots on the 85 per cent value of the ordinate scale and draw a straight line through these points. These two lines give the frequency distribution of equivalent winds over the route.

Use of these curves in Figure 6 is illustrated with three examples.

- a) The per cent of equivalent tailwinds that fall in the 50-70 knot range for the San Francisco-to-New York route is 45 per cent (70 - 25).
- b) Equivalent winds that should not be exceeded between 50 and 95 per cent of the time on the New York-to-San Francisco

route range from -61 to -89 knots.

- c) For the San Francisco-to-New York route an equivalent tailwind of 41 knots can be relied on 85 per cent of the time.

C. VARIATION IN AIRSPEED

The tabulated equivalent wind data were computed for a 450-knot airspeed, but may be used for airspeeds between 300 and 550 knots because the small variation of equivalent wind with airspeed. For airspeeds outside this range, the tabulated values may be modified as follows. If D and R represent the DIRECT and RETURN equivalent wind for a 450 knot airspeed, the corresponding values, D' and R' for the new airspeed, A, are:

$$D' = 1/2 (D - R) + \frac{225}{A} (D + R) \quad (6)$$

$$R' = -1/2 (D - R) + \frac{225}{A} (D + R) \quad (7)$$

These expressions are derived from (1) by setting

$$\left[\bar{w} \right] = - \left[\bar{u} \right] + M \frac{1}{A}$$

where:

$$M = \left\{ \frac{(\bar{v})^2}{2} + \left[\frac{\sigma}{4} \right]^2 \right\}.$$

Then for a 450 knot airspeed

$$D = - \left[\bar{u} \right] + \frac{M}{450} \quad (8)$$

$$R = \left[\bar{u} \right] + \frac{M}{450} \quad (9)$$

and for airspeed, A

$$D' = - \left[\bar{u} \right] + \frac{M}{A} \quad (10)$$

$$R' = \left[\bar{u} \right] + \frac{M}{A} \quad (11)$$

Substitute

$$M = 225 (D + R), \text{ obtained from adding (8) and (9) and}$$

$$\left[\bar{u} \right] = - \frac{D - R}{2}, \text{ obtained from subtracting (9) from (8)}$$

into (10) and (11), thus obtaining (6) and (7).

If D and R are of equal value and of opposite sign, the tabulated values are the same for any airspeed. If $D \neq R$, i.e., a cross wind component is present, D' and R' will differ slightly from D and R.

Per cent reliability equivalent headwinds computed for the new airspeed, A' , will differ by the same amount as the mean values, i.e. $D - D'$, because standard deviations are not sufficiently affected by changes in airspeed².

For example, to compute the direct and return mean equivalent wind for the December-February season over the Atlanta-to-Detroit route for a 675-knot airspeed and at 40,000 feet, we have from Table 4,

$$D = 3 \text{ knots}$$

$$R = -18 \text{ knots}$$

Then,

$$\begin{aligned} D' &= 1/2 \left[3 - (-18) \right] + \frac{225}{675} \left[3 + (-18) \right] \\ &= 5.5 \text{ knots} \end{aligned}$$

$$\begin{aligned} R' &= -1/2 \left[3 - (-18) \right] + \frac{225}{675} \left[3 + (-18) \right] \\ &= -15.5 \text{ knots} \end{aligned}$$

D. GREAT CIRCLE ROUTE LENGTH

The route length in nautical miles is computed over the great-circle course, i.e. the least distance on a sphere, between terminals (Fig. 5).

For completeness, a great circle may be defined as the intersection of the surface of a sphere and a plane which passes through the center of the sphere. A nautical mile is the length of one minute of arc along a great circle on the earth's surface, i.e. the earth's circumference is $360 \times 60 = 21,600$ n. mi. In terms of statute miles, $1 \text{ n. mi.} = 1.1508$ miles. A knot is one nautical mile per hour.

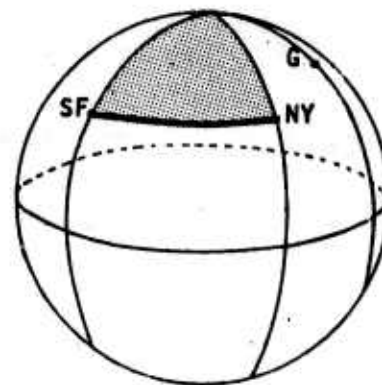


Fig. 5
Great Circle Route Length

For example the great circle distance between New York ($+40^{\circ}38'$, $+73^{\circ}47'$) and San Francisco ($+37^{\circ}38'$, $+122^{\circ}23'$) may be computed from (3).

$$D = 60 \cos^{-1} \left\{ \sin \psi_1 \sin \psi_2 + \cos \psi_1 \cos \psi_2 \cos (\lambda_1 - \lambda_2) \right\} \quad (3)$$

With the aid of Table 2,

$$\begin{aligned} D &= 60 \cos^{-1} \left\{ \sin(40^{\circ}38') \sin(37^{\circ}38') + \cos 40^{\circ}38' \cos 37^{\circ}38' \cos 48^{\circ}36' \right\} \\ &= 60 \cos^{-1} \left\{ .7951 \right\} \\ &= 2240 \text{ n. mi.} \end{aligned}$$

Table 2. Reference Trigonometric Relationships

$$\begin{aligned} \sin(90 + \psi) &= \cos \psi & \cos(90 + \psi) &= -\sin \psi \\ \sin(90 - \psi) &= \cos \psi & \cos(90 - \psi) &= \sin \psi \\ \sin(-\psi) &= -\sin \psi & \cos(-\psi) &= \cos \psi \end{aligned}$$

E. EQUIVALENT ROUTE LENGTH

$+\sin$	$+\sin$
$-\cos$	$+\cos$
$-\sin$	$-\sin$
$-\cos$	$+\cos$

The equivalent route length, for a given reliability equivalent wind, is the distance that an aircraft would fly in still air on a flight having the same duration as that required to fly the route with given per cent equivalent wind. The equivalent route wind may be expressed as

$$L_x = \frac{DA}{A + W_x} \quad (11)$$

where:

L_x = Equivalent route length in knots for x per cent reliability equivalent wind W_x

D = Great circle distance in nautical miles

A = Airspeed in knots.

For example, the 85-per cent reliability route length over the great circle New York-to-San Francisco route at 40,000 feet in the December-February season for an airspeed of 450 knots is

$$\begin{aligned}\text{DIRECT: } L_{85} &= \frac{2240 \times 450}{450 + (-79)} \\ &= 2717 \text{ n. mi.}\end{aligned}$$

$$\begin{aligned}\text{RETURN: } L_{85} &= \frac{2240 \times 450}{450 + (41)} \\ &= 2053 \text{ n. mi.}\end{aligned}$$

V. OCCURRENCE OF HEADWINDS ON BOTH DIRECT AND RETURN FLIGHTS

Over routes characterized by prevailing light winds or by strong beam winds, the direct and return route winds can both appear as a headwind. This situation occurs when the contribution to the mean equivalent wind from the wind components at right angles to the track exceeds the contribution from the wind components along the track. The effect of beam winds on the ground speed becomes apparent when it is realized that an airplane could make no progress in a beam wind equal to its airspeed.

Reliability equivalent winds for some routes appear as headwinds for the direct and return flight. This situation can occur over routes where the mean equivalent wind is about the same magnitude as its standard deviation. For example, a route having a mean equivalent tailwind of 12 knots, and a standard deviation of 15 knots, has an 85 per cent reliability headwind of -3 knots. In this example a tailwind has not become a headwind, but

rather a headwind of -3 knots is not likely to be exceeded on 85 per cent of occasions and a tailwind of 12 knots can be relied on 50 per cent of occasions.

VI. RELIABILITY OF RESULTS

The reliability of the tabulated equivalent headwinds in being representative of the actual route winds over great circle routes depends largely upon the assumption that wind distributions in the free atmosphere can be treated by the circular normal distribution. This distribution requires that the zonal and meridional components of wind be uncorrelated and that their standard deviation be equal. From physical considerations, however, some degree of ellipticity must be present, otherwise there would be no mean transport of energy in the atmosphere as is observed. For most conditions, the degree of ellipticity is small and the assumed circular normal distribution acceptable. Brooks¹⁰ pointed out that the assumption of circularity is likely to be weakest in frontal zones, in the vicinity of jet streams and in areas characterized by distinct seasonal wind variation such as the boundary region between a monsoon circulation and the circulation above.

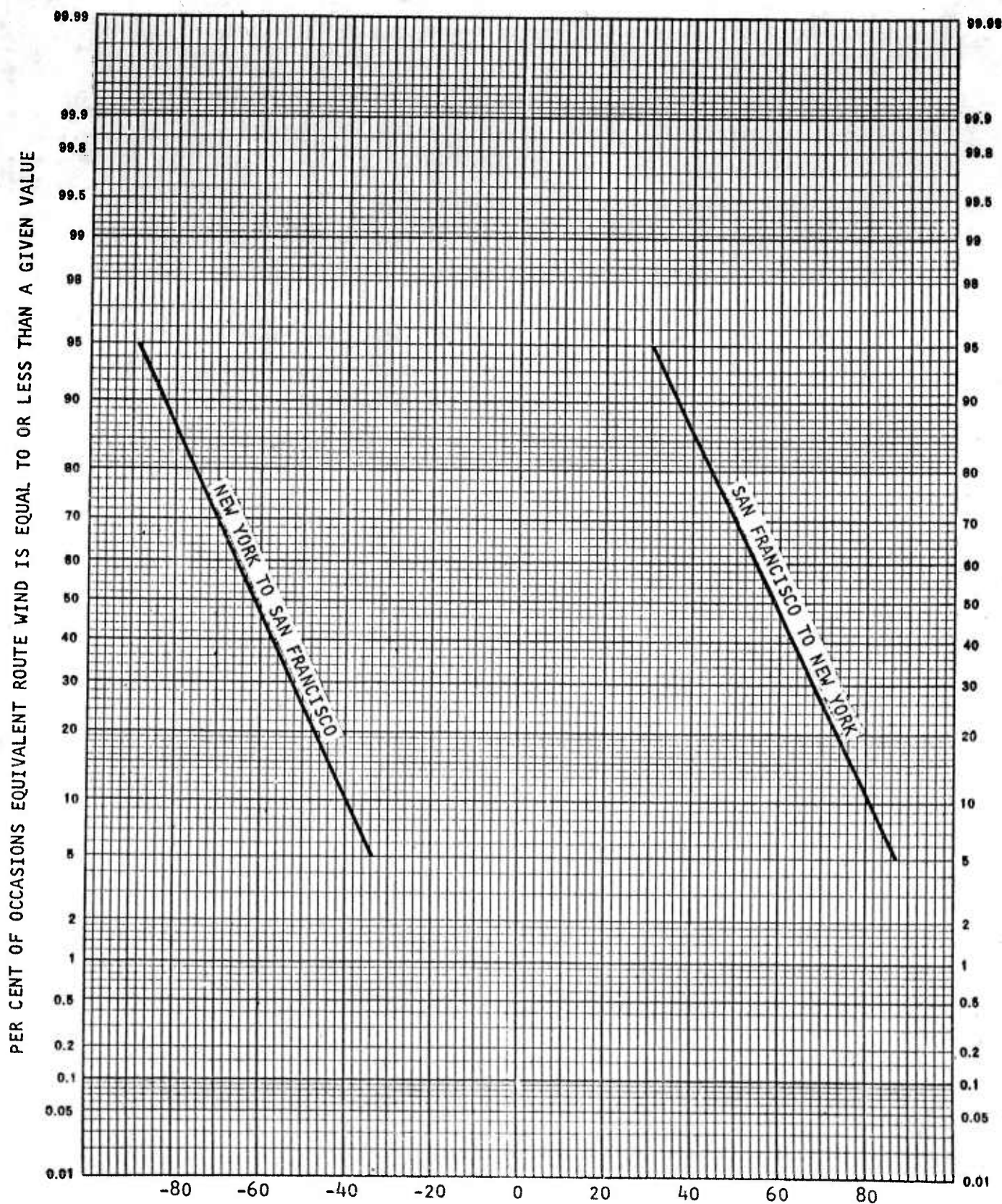
The tabulated values are intended as long term estimates of en route winds and as such the actual winds in any one season may differ appreciably from them. This condition particularly occurs where air routes closely parallel the mean position of the jet stream. Where air routes routinely traverse normal to the jet stream, however, only small differences between the tabulated and observed route winds should occur.

VII. CONCLUSION

The application of equivalent winds can aid agencies concerned with the problems of aircraft logistics to estimate the long term economic

capabilities of carriers over new routes and at the elevated cruise levels of jet aircraft. Considerable effort is still needed to combine the element of temperature with that of wind into one reliability factor which would reflect the effect of the environment of aircraft performance. The solution of this problem involves not only combining and presenting the probabilities that equivalent headwinds and en route and surface temperatures occur but also weighing these factors according to their individual effect on aircraft performance.

While the circular normal distribution adequately describes the distribution of upper air winds, except in some regions as noted, the general bivariate normal distribution appears to provide the best description. Even this elliptical distribution, however, may not adequately describe the winds in some regions. At present, wind statistics based on the bivariate normal distribution are available only for the Northern Hemisphere.

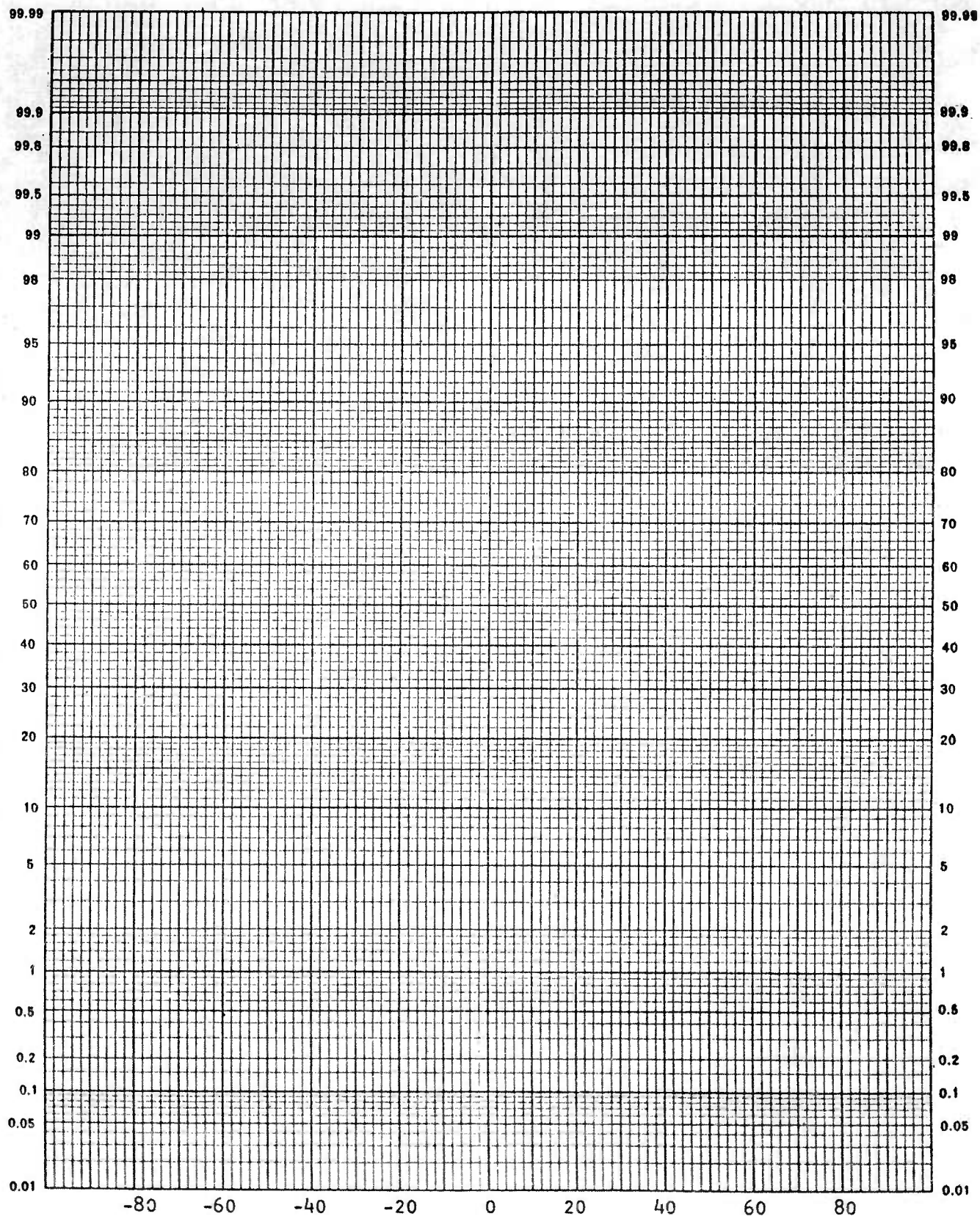


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PER CENT OF OCCASIONS EQUIVALENT ROUTE WIND IS EQUAL TO OR LESS THAN A GIVEN VALUE



EQUIVALENT ROUTE WIND - KNOTS
ARITHMETIC PROBABILITY PAPER

PER CENT OF OCCASIONS EQUIVALENT ROUTE WIND IS EQUAL TO OR LESS THAN A GIVEN VALUE

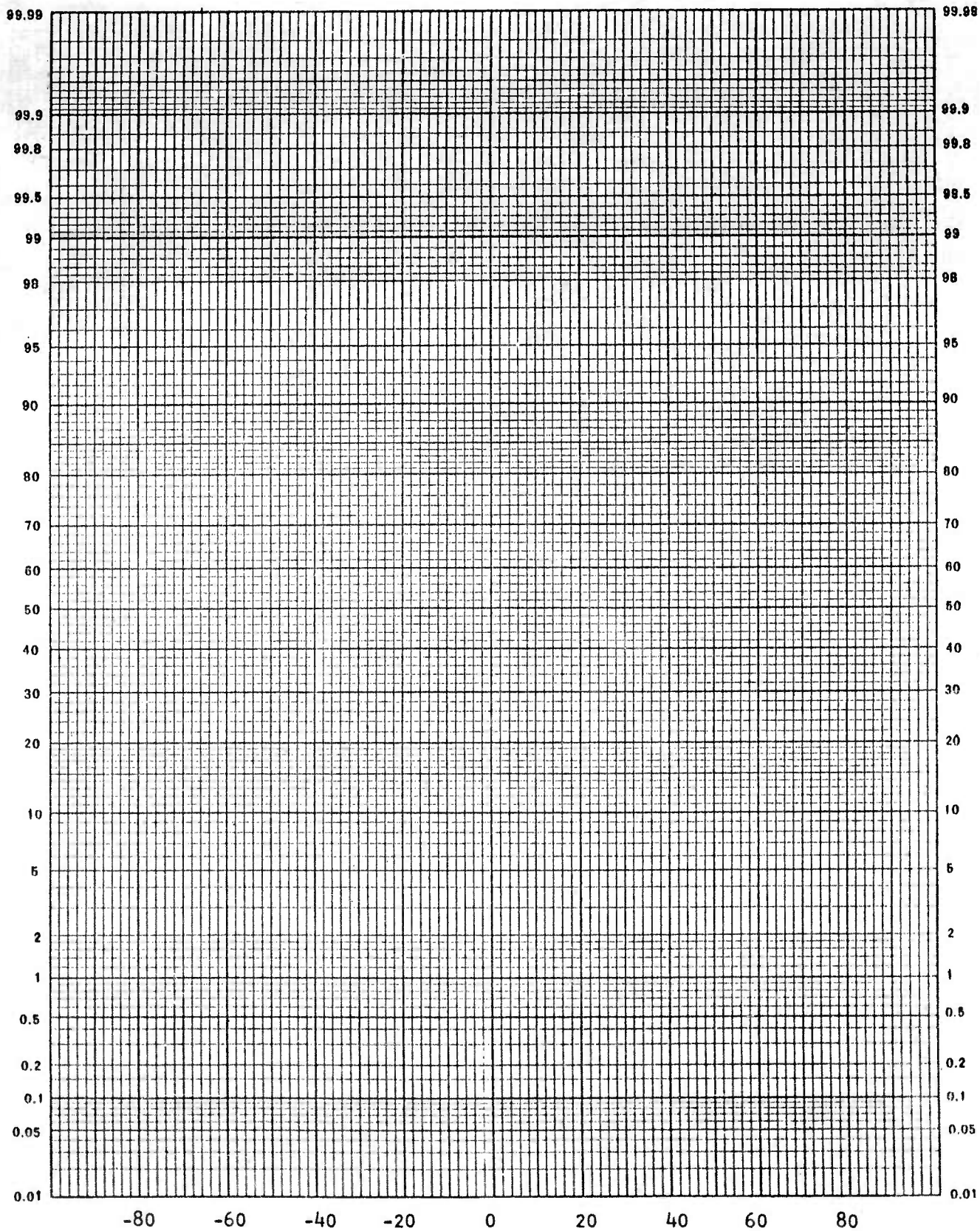


TABLE 3
EQUIVALENT WINDS AT THE 5000-, 10,000- AND
15,000-FOOT LEVELS FOR ROUTES $\leq$ 400 NAUTICAL
MILES IN LENGTH

TABLE 3. EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
ABILENE TO BIG SPRING																		
15,000	-30	-25	-5	-12	-16	-30	-38	30	24	4	12	16	4	-2	18	17	11	16
10,000	-20	-15	-4	-8	-11	-21	-26	20	15	4	8	11	2	-2	14	13	10	12
5,000	-9	-6	-5	-4	-6	-14	-18	8	6	4	3	5	-3	-7	14	13	9	12
ABILENE TO DALLAS																		
15,000	31	24	5	12	16	5	-1	-31	-25	-6	-13	-17	-31	-39	18	17	11	16
10,000	21	16	5	8	12	3	-2	-21	-16	-5	-9	-12	-22	-27	14	13	10	13
5,000	9	7	6	4	7	-1	-6	-10	-8	-6	-5	-7	-15	-20	14	13	9	12
ABILENE TO EL PASO																		
15,000	-29	-24	-4	-11	-16	-29	-36	28	23	4	11	15	4	-1	17	15	10	15
10,000	-19	-14	-4	-7	-10	-19	-24	18	14	4	7	10	2	-2	13	12	9	11
5,000	-6	-5	-2	-1	-3	-10	-14	6	4	2	1	3	-4	-7	12	11	7	10
ABILENE TO HOUSTON																		
15,000	21	17	1	9	11	0	-5	-23	-19	-1	-10	-12	-24	-31	17	15	10	15
10,000	13	9	0	5	6	-2	-6	-14	-10	-1	-6	-7	-16	-21	13	13	9	12
5,000	4	1	-3	1	0	-7	-11	-5	-1	3	-1	-1	-9	-13	13	12	8	11
ABILENE TO FT. WORTH																		
15,000	31	24	5	12	16	5	-1	-31	-25	-6	-13	-17	-31	-39	18	17	11	16
10,000	21	16	5	8	12	2	-2	-21	-16	-5	-8	-12	-22	-27	14	13	10	13
5,000	9	7	6	4	7	-1	-6	-10	-8	-6	-5	-7	-15	-20	14	13	9	12
ABILENE TO LUBBOCK																		
15,000	-24	-19	-2	-11	-13	-26	-33	23	18	2	11	12	1	-4	18	17	11	16
10,000	-15	-11	-2	-7	-8	-17	-22	15	10	2	6	7	-1	-5	14	13	10	12
5,000	-4	-2	2	0	-1	-9	-13	4	1	-3	0	0	-8	-12	13	13	9	12
ABILENE TO MIDLAND																		
15,000	-30	-24	-5	-12	-16	-30	-37	29	24	4	11	15	4	-1	18	16	11	16
10,000	-20	-15	-5	-8	-11	-21	-26	20	15	4	7	11	2	-2	14	13	10	12
5,000	-9	-7	-5	-4	-6	-14	-18	8	6	5	3	5	-2	-6	13	13	9	12
AKRON TO CHARLESTON																		
15,000	-5	1	-1	-5	-2	-15	-22	0	-4	0	3	0	-12	-19	21	21	12	20
10,000	-3	1	1	-2	-1	-10	-16	0	-3	-2	0	-1	-11	-16	16	17	12	15
5,000	-1	1	0	-1	0	-9	-13	0	-1	-1	0	0	-9	-13	14	14	10	12
AKRON TO CHICAGO																		
15,000	-34	-26	-19	-23	-26	-39	-47	38	25	18	22	25	13	6	20	20	13	19
10,000	-28	-20	-15	-18	-20	-30	-36	28	19	14	18	19	9	4	15	16	12	15
5,000	-15	-11	-8	-10	-11	-20	-24	15	10	8	10	10	2	-3	14	14	10	12
AKRON TO CINCINNATI																		
15,000	-35	-21	-14	-21	-21	-36	-43	32	19	14	19	20	8	1	21	21	12	20
10,000	-25	-16	-11	-15	-16	-27	-33	23	15	10	15	15	5	0	16	17	12	15
5,000	-13	-9	-6	-8	-9	-17	-22	12	8	6	8	8	0	-5	14	14	10	12
AKRON TO CLEVELAND																		
15,000	-24	-18	-11	-12	-15	-29	-37	20	16	10	10	13	1	-6	22	22	13	21
10,000	-16	-14	-10	-11	-12	-23	-29	14	13	9	9	11	1	-5	17	18	12	16
5,000	-9	-8	-5	-5	-7	-15	-21	8	7	5	5	6	-3	-8	15	15	10	13
AKRON TO COLUMBUS																		
15,000	-33	-19	-14	-21	-21	-35	-43	31	17	13	19	19	7	0	21	21	13	20
10,000	-24	-15	-10	-15	-15	-26	-32	22	13	10	14	14	4	-2	16	17	12	15
5,000	-12	-8	-6	-8	-8	-17	-22	12	7	5	8	8	-1	-6	15	15	10	13
AKRON TO DAYTON																		
15,000	-38	-24	-16	-23	-24	-39	-47	37	22	16	22	23	10	4	21	21	13	20
10,000	-27	-18	-12	-17	-18	-29	-35	26	17	12	17	17	7	2	16	17	12	15
5,000	-14	-10	-7	-9	-10	-19	-24	14	9	7	9	9	1	-4	15	15	10	13
AKRON TO DETROIT																		
15,000	-31	-22	-15	-18	-21	-35	-42	29	21	14	16	19	7	0	21	21	13	20
10,000	-22	-17	-13	-14	-16	-27	-33	21	16	12	14	15	5	0	16	17	12	15
5,000	-12	-9	-7	-8	-9	-18	-23	11	9	7	7	8	-1	-5	15	15	10	13

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
AKRON TO NEW YORK																				
15,000	41	28	19	24	27	14	8	-43	-29	-19	-25	-27	-42	-50	20	20	349 N.MI.			
10,000	30	21	15	19	21	11	6	-31	-22	-15	-20	-21	-32	-38	16	17	12	19		
5,000	16	12	9	10	11	3	-1	-16	-12	-9	-10	-12	-20	-25	14	14	11	14		
AKRON TO PITTSBURGH																				
15,000	38	26	17	20	24	11	4	-40	-27	-17	-22	-25	-40	-48	22	22	62 N.MI.			
10,000	27	20	14	17	19	9	3	-28	-21	-15	-18	-20	-31	-37	17	18	13	20		
5,000	14	11	8	9	10	1	-3	-15	-11	-8	-9	-10	-20	-25	15	15	12	15		
AKRON TO TOLEDO																				
15,000	-39	-26	-18	-23	-25	-40	-48	38	25	18	21	24	12	5	21	21	113 N.MI.			
10,000	-28	-20	-15	-18	-20	-31	-37	27	19	14	17	19	9	3	16	17	13	20		
5,000	-15	-11	-8	-10	-11	-20	-25	14	10	8	9	10	1	-3	15	15	12	15		
AKRON TO WASHINGTON, D. C.																				
15,000	35	26	15	18	22	10	3	-37	-27	-16	-19	-23	-38	-46	21	21	238 N.MI.			
10,000	26	20	13	16	18	8	3	-27	-21	-14	-17	-19	-30	-35	16	17	12	19		
5,000	13	11	7	8	10	1	-3	-14	-11	-8	-8	-10	-19	-23	14	14	11	15		
AKRON TO YOUNGSTOWN																				
15,000	35	20	15	22	22	9	2	-37	-22	-16	-23	-23	-38	-46	22	22	41 N.MI.			
10,000	25	15	11	16	16	6	0	-26	-16	-12	-17	-17	-28	-35	17	18	13	21		
5,000	13	8	6	9	9	0	-5	-14	-9	-7	-9	-9	-18	-24	15	15	12	16		
ALAMOGORDO TO ALBUQUERQUE																				
15,000	-6	-4	4	-3	-1	-12	-18	3	2	-4	2	0	-10	-15	19	17	134 N.MI.			
10,000	-4	-1	2	0	-1	-8	-13	3	1	-2	0	0	-8	-12	14	12	11	16		
5,000	5	5	7	6	6	0	-3	-5	-6	-7	-6	-6	-12	-15	10	10	9	12		
ALAMOGORDO TO EL PASO																				
15,000	-8	-8	-7	-4	-7	-16	-22	6	6	7	3	5	-5	-10	19	16	65 N.MI.			
10,000	-5	-5	-5	-4	-5	-12	-17	4	5	5	4	4	-3	-8	14	12	11	15		
5,000	-7	-7	-7	-4	-6	-12	-16	7	7	7	4	6	0	-4	11	10	9	11		
ALBANY, GA. TO ATLANTA, GA.																				
15,000	-1	-4	0	0	-1	-11	-17	-3	1	0	-1	-1	-11	-17	18	18	128 N.MI.			
10,000	0	-2	2	0	0	-9	-14	-2	0	-2	-1	-1	-10	-14	14	15	10	17		
5,000	3	1	1	0	1	-6	-11	-3	-2	-1	0	-2	-9	-14	13	13	9	14		
ALBANY, GA. TO MACON																				
15,000	14	9	3	6	7	-3	-8	-17	-11	-3	-7	-9	-20	-27	18	18	74 N.MI.			
10,000	11	7	4	4	6	-2	-7	-12	-8	-5	-5	-7	-16	-21	14	15	10	17		
5,000	8	5	3	2	5	-3	-7	-8	-6	-4	-3	-5	-13	-17	13	13	9	14		
ALBANY, GA. TO TALLAHASSEE																				
15,000	-8	-4	-1	-3	-4	-14	-20	5	2	1	2	2	-7	-13	17	17	68 N.MI.			
10,000	-6	-3	-4	-2	-4	-12	-17	5	2	3	2	3	-5	-10	14	14	10	16		
5,000	-6	-4	-3	-2	-4	-11	-16	6	4	3	1	3	-4	-8	13	12	9	13		
ALBANY, GA. TO TAMPA																				
15,000	8	8	-1	2	4	-5	-10	-10	-10	0	-3	-5	-15	-21	16	16	231 N.MI.			
10,000	3	4	-2	1	1	-7	-11	-4	-5	2	-1	-2	-10	-15	13	13	9	14		
5,000	-4	-1	-2	-1	-2	-9	-13	3	1	2	1	2	-5	-9	12	11	8	12		
ALBANY, N. Y. TO BINGHAMPTON																				
15,000	-39	-26	-20	-25	-26	-41	-48	38	24	19	24	25	12	5	22	22	102 N.MI.			
10,000	-28	-19	-15	-19	-20	-31	-37	27	18	14	18	19	8	3	18	18	14	21		
5,000	-15	-10	-9	-11	-11	-20	-26	14	10	9	10	11	2	-3	15	15	12	16		
ALBANY, N. Y. TO BOSTON																				
15,000	36	27	21	23	26	13	6	-38	-28	-21	-24	-27	-41	-49	22	22	126 N.MI.			
10,000	28	20	16	18	20	10	4	-29	-21	-16	-19	-21	-32	-38	18	18	14	21		
5,000	15	11	10	10	12	3	-2	-16	-12	-11	-11	-12	-21	-27	15	15	12	16		
ALBANY, N. Y. TO BUFFALO																				
15,000	-40	-27	-21	-25	-27	-41	-49	38	26	21	24	26	13	7	22	21	217 N.MI.			
10,000	-29	-20	-16	-20	-21	-32	-38	29	19	16	19	20	10	4	17	17	14	20		
5,000	-16	-11	-10	-11	-12	-21	-26	16	11	10	11	11	3	-2	15	15	12	15		

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	DIRECT							RETURN														
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
ALBANY, N.Y. TO GLENS FALLS																			37 N.MI.			
15,000	10	3	3	8	6	-7	-15	-15	-5	-5	-10	-8	-22	-30	23	22	14	21				
10,000	5	1	1	4	3	-8	-14	-8	-3	-2	-6	-4	-15	-21	18	18	12	16				
5,000	2	0	1	3	1	-8	-13	-3	-1	-2	-3	-2	-11	-16	16	16	11	13				
ALBANY, N.Y. TO HARTFORD																			80 N.MI.			
15,000	20	18	13	12	15	3	-5	-23	-20	-14	-14	-17	-31	-38	22	22	14	21				
10,000	18	14	11	11	13	3	-3	-20	-16	-12	-12	-14	-25	-32	18	18	12	16				
5,000	10	9	7	6	8	-1	-6	-11	-9	-7	-7	-8	-18	-23	15	15	11	13				
ALBANY, N.Y. TO NEW YORK																			127 N.MI.			
15,000	-6	1	0	-5	-2	-15	-23	2	-4	-1	2	0	-13	-20	22	21	14	20				
10,000	-1	1	1	-2	0	-10	-16	-2	-3	-2	1	-2	-12	-18	17	18	12	15				
5,000	0	2	0	0	0	-8	-13	-1	-3	-1	0	-1	-10	-15	15	15	11	13				
ALBANY, N.Y. TO ROCHESTER, N.Y.																			171 N.MI.			
15,000	-39	-27	-21	-25	-27	-41	-49	38	26	21	24	26	13	6	22	21	14	20				
10,000	-29	-20	-16	-19	-21	-32	-38	28	19	16	19	20	10	4	17	18	12	15				
5,000	-16	-11	-10	-11	-12	-21	-26	15	11	10	10	11	3	-2	15	15	11	13				
ALBANY, N.Y. TO SYRACUSE																			104 N.MI.			
15,000	-38	-27	-21	-24	-27	-41	-48	36	26	21	23	26	13	6	22	22	14	21				
10,000	-29	-20	-16	-19	-20	-32	-38	28	19	16	18	20	9	4	18	18	12	16				
5,000	-16	-12	-10	-11	-12	-21	-26	15	11	10	10	11	2	-3	15	15	11	13				
ALBUQUERQUE TO AMARILLO																			241 N.MI.			
15,000	28	22	9	13	17	6	0	-28	-23	-9	-14	-17	-30	-37	19	17	11	16				
10,000	18	13	5	9	11	2	-2	-18	-14	-5	-9	-11	-20	-25	14	12	10	12				
5,000	5	4	3	1	3	-3	-7	-5	-4	-3	-2	-3	-10	-14	11	11	8	10				
ALBUQUERQUE TO DENVER																			295 N.MI.			
15,000	4	5	7	2	4	-6	-12	-6	-6	-7	-3	-6	-16	-22	19	17	11	16				
10,000	2	3	4	2	3	-5	-9	-3	-4	-4	-3	-3	-11	-15	13	11	9	12				
5,000	6	6	7	6	6	1	-3	-6	-6	-7	-6	-6	-12	-15	9	10	7	9				
ALBUQUERQUE TO EL PASO																			195 N.MI.			
15,000	0	-1	-6	0	-2	-12	-17	-2	-1	5	-1	1	-9	-15	18	16	10	15				
10,000	0	-1	-3	-2	-2	-9	-13	-1	0	3	1	1	-7	-11	13	11	9	11				
5,000	-6	-6	-7	-5	-6	-12	-15	6	6	7	5	6	0	-3	10	10	6	9				
ALBUQUERQUE TO LUBBOCK																			251 N.MI.			
15,000	26	21	6	12	15	4	-1	-27	-21	-6	-13	-15	-28	-35	18	17	11	16				
10,000	17	12	4	7	9	1	-3	-17	-12	-4	-8	-10	-18	-23	14	12	9	12				
5,000	3	1	-1	-2	0	-6	-10	-3	-2	1	1	0	-7	-11	11	11	8	10				
ALBUQUERQUE TO PHOENIX																			286 N.MI.			
15,000	-24	-19	-10	-11	-15	-26	-32	23	19	9	10	14	4	-1	18	16	10	15				
10,000	-13	-11	-6	-7	-9	-16	-21	13	10	5	7	8	1	-3	13	10	9	11				
5,000	-3	-3	-1	3	-1	-6	-8	3	2	1	-3	1	-4	-7	8	8	5	7				
ALBUQUERQUE TO ROSWELL																			141 N.MI.			
15,000	18	15	2	9	10	-1	-6	-20	-16	-2	-9	-11	-23	-30	19	17	11	16				
10,000	12	8	1	4	6	-2	-6	-13	-9	-2	-5	-7	-15	-20	14	12	9	12				
5,000	-1	-2	-5	-5	-4	-10	-13	1	2	5	5	3	-3	-6	10	10	7	9				
ALBUQUERQUE TO SANTA FE																			42 N.MI.			
15,000	15	12	9	6	10	0	-6	-16	-13	-9	-7	-11	-22	-29	20	17	11	16				
10,000	8	7	5	5	6	-2	-6	-9	-8	-5	-6	-7	-15	-19	14	12	10	12				
5,000	6	6	6	4	5	-1	-4	-6	-6	-6	-4	-6	-11	-15	10	10	7	9				
ALEXANDRIA TO BATON ROUGE																			87 N.MI.			
15,000	22	19	4	10	13	2	-3	-24	-21	-4	-11	-14	-26	-33	17	17	11	16				
10,000	14	11	0	7	7	-2	-6	-15	-12	-1	-7	-8	-18	-23	14	14	10	13				
5,000	5	3	0	3	3	-5	-9	-6	-4	-1	-3	-3	-11	-16	14	13	9	12				
ALEXANDRIA TO SHREVEPORT																			93 N.MI.			
15,000	-20	-17	-4	-10	-11	-24	-31	17	16	3	9	10	0	-5	18	17	11	17				
10,000	-13	-10	0	-6	-7	-16	-21	11	9	0	6	6	-3	-7	14	14	10	13				
5,000	-4	-2	0	-2	-2	-10	-15	4	2	-1	2	1	-6	-11	14	13	9	12				

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
ALLENTOWN TO CLEVELAND																				
15,000	-42	-29	-19	-24	-27	-41	-50	41	28	19	23	26	14	8	21	20	294 N.MI.			
10,000	-30	-22	-15	-19	-21	-32	-38	29	21	15	19	20	10	5	16	17	12	19		
5,000	-16	-12	-9	-10	-11	-20	-25	16	12	9	10	11	3	-2	14	14	10	12		
ALLENTOWN TO HARRISBURG																				
15,000	-41	-27	-18	-25	-26	-41	-50	39	25	17	24	25	12	5	22	22	70 N.MI.			
10,000	-29	-20	-14	-19	-20	-31	-37	28	19	13	18	19	8	3	17	18	13	20		
5,000	-15	-11	-8	-10	-11	-20	-25	14	10	8	9	10	1	-3	15	15	10	13		
ALLENTOWN TO NEW YORK																				
15,000	41	29	19	24	27	14	7	-42	-30	-20	-25	-28	-43	-51	22	22	75 N.MI.			
10,000	30	22	15	19	21	10	5	-31	-23	-16	-19	-21	-33	-39	18	18	13	20		
5,000	16	12	9	10	11	3	-2	-16	-13	-9	-10	-12	-21	-26	15	15	12	15		
ALLENTOWN TO PHILADELPHIA																				
15,000	2	7	3	0	3	-10	-17	-7	-10	-4	-2	-6	-19	-26	22	22	47 N.MI.			
10,000	5	6	4	2	4	-6	-12	-7	-8	-5	-3	-6	-16	-22	18	18	13	20		
5,000	3	4	2	2	3	-6	-11	-4	-5	-3	-2	-3	-12	-17	15	15	12	15		
ALLENTOWN TO PITTSBURGH																				
15,000	-43	-29	-19	-25	-27	-42	-51	42	28	19	24	27	14	8	21	21	218 N.MI.			
10,000	-31	-22	-15	-20	-21	-32	-38	30	21	15	19	21	10	5	17	17	12	20		
5,000	-16	-12	-9	-10	-11	-20	-25	16	12	8	10	11	3	-2	14	14	10	12		
ALLENTOWN TO READING																				
15,000	-38	-24	-16	-23	-24	-39	-47	36	22	16	22	23	10	3	22	22	29 N.MI.			
10,000	-26	-18	-12	-17	-18	-29	-36	25	17	12	16	17	6	1	18	18	13	21		
5,000	-14	-9	-7	-9	-9	-19	-24	13	9	7	8	9	0	-5	15	15	12	16		
ALLENTOWN TO SCRANTON																				
15,000	-11	-12	-7	-5	-8	-21	-29	7	10	5	2	6	-7	-14	22	22	52 N.MI.			
10,000	-10	-10	-7	-5	-8	-18	-24	7	8	6	4	6	-4	-10	18	18	13	21		
5,000	-5	-6	-4	-3	-4	-13	-18	4	5	3	2	4	-5	-10	15	15	12	16		
ALLENTOWN TO SYRACUSE																				
15,000	-8	-10	-5	-3	-6	-19	-26	3	7	4	0	4	-9	-16	22	21	151 N.MI.			
10,000	-7	-8	-6	-4	-6	-16	-22	5	6	5	2	4	-6	-11	17	18	13	20		
5,000	-4	-5	-3	-2	-3	-12	-17	3	4	3	1	3	-6	-11	15	15	12	15		
ALLENTOWN TO WASHINGTON, D.C.																				
15,000	-28	-16	-11	-18	-17	-31	-39	25	13	10	16	15	3	-4	21	21	131 N.MI.			
10,000	-18	-12	-8	-12	-12	-23	-29	16	10	7	11	11	1	-5	17	17	13	20		
5,000	-9	-6	-4	-6	-6	-15	-20	9	5	4	5	6	-3	-8	15	15	12	15		
AMARILLO TO COLORADO SPRINGS																				
15,000	-18	-13	-5	-11	-11	-22	-29	16	11	4	10	9	-1	-6	19	17	259 N.MI.			
10,000	-12	-7	-3	-7	-7	-15	-20	11	7	2	6	6	-2	-6	14	12	11	16		
5,000	0	1	4	2	2	-5	-9	-1	-2	-4	-3	-3	-9	-13	11	11	10	12		
AMARILLO TO DALLAS																				
15,000	25	20	5	13	14	3	-2	-27	-22	-5	-13	-15	-28	-35	18	17	280 N.MI.			
10,000	17	12	3	8	9	1	-4	-18	-12	-3	-8	-10	-19	-24	14	13	10	16		
5,000	5	3	1	2	2	-5	-10	-6	-4	-1	-2	-3	-11	-16	13	13	9	12		
AMARILLO TO DENVER																				
15,000	-16	-11	-4	-10	-10	-21	-27	14	10	4	9	8	-2	-7	19	17	311 N.MI.			
10,000	-11	-7	-2	-6	-6	-14	-19	10	6	2	6	6	-2	-7	13	12	11	16		
5,000	1	2	4	3	3	-4	-8	-1	-3	-5	-3	-3	-10	-13	11	11	10	12		
AMARILLO TO LUBBOCK																				
15,000	-4	-3	-3	0	-2	-13	-19	1	1	2	-1	1	-10	-16	19	18	94 N.MI.			
10,000	-2	-4	-2	-1	-2	-11	-15	1	3	2	1	2	-7	-11	14	13	11	16		
5,000	-5	-6	-9	-5	-6	-14	-18	4	5	9	5	6	-2	-6	13	13	10	13		
AMARILLO TO OKLAHOMA CITY																				
15,000	31	24	8	15	18	6	1	-32	-25	-8	-15	-18	-32	-40	19	18	200 N.MI.			
10,000	21	16	5	10	12	3	-1	-21	-16	-6	-10	-13	-23	-28	14	14	11	16		
5,000	8	7	7	5	7	-1	-6	-8	-7	-7	-6	-7	-15	-20	13	14	10	13		

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	DIRECT								RETURN								JAN	APR	JUL	OCT		
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
AMARILLO TO WICHITA																			258 N.MI.			
15,000	24	19	8	12	15	4	-2	-26	-20	-8	-12	-16	-28	-35	19	18	11	17				
10,000	17	13	6	8	11	2	-3	-17	-14	-6	-9	-11	-20	-25	14	14	10	13				
5,000	7	8	9	6	8	0	-5	-8	-8	-9	-7	-8	-16	-21	13	14	10	12				
ANDERSON TO ATLANTA																			99 N.MI.			
15,000	-34	-25	-7	-16	-19	-33	-42	33	23	7	15	18	6	0	19	19	11	18				
10,000	-24	-17	-7	-11	-14	-25	-31	23	16	7	10	13	4	-1	15	15	10	14				
5,000	-13	-10	-5	-4	-8	-16	-21	12	9	5	4	7	-1	-5	14	13	9	12				
ANDERSON TO GREENVILLE																			28 N.MI.			
15,000	28	18	6	12	14	3	-3	-30	-20	-6	-14	-16	-30	-38	20	20	11	19				
10,000	18	13	6	9	11	1	-4	-20	-14	-6	-10	-12	-22	-28	15	16	10	15				
5,000	10	7	4	3	6	-2	-7	-11	-8	-4	-4	-6	-15	-19	14	13	9	13				
ASHEVILLE TO ATLANTA																			142 N.MI.			
15,000	-30	-20	-6	-13	-16	-29	-38	28	18	6	12	14	3	-3	19	19	11	18				
10,000	-20	-14	-6	-9	-12	-22	-27	18	13	6	9	11	2	-3	15	15	10	14				
5,000	-11	-8	-4	-4	-6	-15	-19	10	8	4	3	6	-2	-6	14	13	9	12				
ASHEVILLE TO BRISTOL																			63 N.MI.			
15,000	7	1	1	3	3	-9	-15	-11	-4	-1	-5	-5	-17	-24	20	20	11	19				
10,000	3	1	1	2	2	-8	-13	-5	-2	-1	-3	-3	-12	-18	15	16	11	15				
5,000	2	1	0	0	1	-8	-12	-3	-2	0	-1	-1	-9	-14	14	13	9	13				
ASHEVILLE TO CHARLOTTE																			79 N.MI.			
15,000	36	29	10	17	21	8	2	-37	-30	-10	-18	-22	-37	-46	20	20	11	19				
10,000	27	20	9	12	16	6	1	-28	-21	-9	-13	-17	-28	-34	15	16	11	15				
5,000	14	11	6	5	9	0	-4	-15	-11	-6	-5	-9	-18	-23	14	13	9	13				
ASHEVILLE TO GREENSBORO																			132 N.MI.			
15,000	38	27	10	18	21	9	3	-39	-28	-11	-19	-22	-38	-46	20	20	11	19				
10,000	27	19	9	13	16	6	1	-27	-20	-9	-14	-17	-28	-34	15	16	11	15				
5,000	14	10	6	5	8	0	-4	-15	-11	-6	-6	-9	-17	-22	14	13	9	12				
ASHEVILLE TO KNOXVILLE																			74 N.MI.			
15,000	-35	-28	-10	-17	-21	-36	-44	34	27	10	16	20	8	1	20	20	11	19				
10,000	-27	-20	-9	-13	-16	-27	-33	26	19	8	12	16	5	0	15	16	11	15				
5,000	-14	-11	-6	-6	-9	-17	-22	14	10	6	5	8	0	-4	14	13	9	13				
ATLANTA TO AUGUSTA, GA.																			123 N.MI.			
15,000	34	27	8	15	19	7	1	-35	-28	-8	-16	-20	-35	-43	19	19	11	18				
10,000	25	19	7	11	14	5	0	-25	-19	-7	-11	-15	-26	-32	15	15	10	14				
5,000	12	10	5	4	8	0	-4	-13	-10	-5	-5	-8	-16	-21	13	13	9	12				
ATLANTA TO BIRMINGHAM																			116 N.MI.			
15,000	-36	-28	-8	-16	-20	-35	-43	35	27	7	16	19	7	1	19	19	11	18				
10,000	-25	-19	-7	-11	-15	-26	-32	25	18	6	11	14	4	0	15	15	10	14				
5,000	-13	-10	-5	-5	-8	-17	-21	13	10	5	5	8	0	-5	14	13	9	12				
ATLANTA TO CHARLESTON, S.C.																			225 N.MI.			
15,000	33	27	7	15	18	7	1	-34	-27	-7	-15	-19	-34	-41	18	18	10	17				
10,000	24	18	6	10	13	4	-1	-24	-19	-6	-10	-14	-25	-31	14	15	10	13				
5,000	11	9	5	4	7	-1	-5	-12	-10	-5	-5	-7	-15	-20	13	12	9	12				
ATLANTA TO CHARLESTON, W.VA.																			315 N.MI.			
15,000	20	11	5	9	10	-1	-6	-23	-13	-5	-11	-12	-24	-32	19	19	11	18				
10,000	12	8	4	7	7	-1	-6	-14	-9	-5	-8	-8	-18	-23	14	15	10	14				
5,000	7	5	2	2	4	-4	-8	-8	-5	-3	-3	-4	-12	-17	13	13	9	12				
ATLANTA TO CHARLOTTE																			197 N.MI.			
15,000	34	25	8	16	19	7	1	-36	-26	-8	-16	-20	-34	-43	19	19	11	18				
10,000	24	17	7	11	14	4	0	-25	-18	-8	-12	-15	-25	-31	15	15	10	14				
5,000	13	10	5	4	7	0	-5	-13	-10	-5	-5	-8	-16	-21	14	13	9	12				
ATLANTA TO CHATTANOOGA																			91 N.MI.			
15,000	-12	-13	-4	-6	-8	-20	-26	8	10	3	5	6	-5	-11	19	19	11	18				
10,000	-10	-9	-2	-4	-6	-15	-21	8	7	2	4	5	-4	-9	15	15	10	14				
5,000	-4	-3	-2	-2	-3	-11	-15	3	3	2	2	2	-6	-10	14	13	9	12				

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HEIGHT IN FEET	EQUIVALENT HEADWINDS*												STANDARD DEVIATION							
	DIRECT								RETURN								JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85						
ATLANTA TO CINCINNATI																				
15,000	1	-3	-1	0	-1	-11	-18	-6	0	0	-2	-1	-13	-19	19	19	324 N.MI.	18		
10,000	-1	-2	0	0	-1	-10	-15	-2	0	0	-1	-1	-9	-14	14	15	10	14		
5,000	0	0	0	0	0	-8	-12	-1	0	0	0	0	-8	-12	14	13	9	12		
ATLANTA TO COLUMBIA																				
15,000	35	27	8	16	20	8	2	-36	-28	-8	-17	-20	-36	-44	19	18	166 N.MI.	18		
10,000	25	19	7	11	15	5	0	-26	-20	-7	-12	-15	-26	-32	15	15	10	14		
5,000	13	10	5	5	8	0	-4	-13	-10	-6	-5	-8	-17	-21	13	13	9	12		
ATLANTA TO COLUMBUS																				
15,000	-18	-11	-3	-7	-9	-21	-28	15	8	3	6	7	-3	-9	19	18	73 N.MI.	17		
10,000	-12	-8	-5	-5	-7	-16	-21	11	6	4	4	6	-3	-8	15	15	10	14		
5,000	-8	-6	-3	-2	-5	-13	-17	7	5	3	2	4	-4	-8	14	13	9	12		
ATLANTA TO GREENSBORO																				
15,000	33	23	8	15	18	6	1	-35	-25	-8	-16	-19	-34	-42	19	19	265 N.MI.	18		
10,000	23	16	7	11	14	4	0	-24	-17	-8	-12	-14	-25	-31	14	15	10	14		
5,000	12	9	5	4	7	-1	-5	-13	-10	-5	-5	-8	-16	-20	13	12	9	12		
ATLANTA TO GREENVILLE																				
15,000	32	22	7	14	17	5	0	-34	-24	-7	-15	-18	-33	-41	19	19	126 N.MI.	18		
10,000	22	16	7	10	13	3	-1	-23	-17	-7	-11	-14	-24	-30	15	15	10	14		
5,000	12	9	5	4	7	-1	-5	-13	-9	-5	-4	-7	-16	-21	14	13	9	12		
ATLANTA TO INDIANAPOLIS																				
15,000	-7	-9	-3	-5	-5	-17	-23	3	6	3	3	3	-7	-13	19	19	376 N.MI.	18		
10,000	-6	-6	-2	-3	-4	-13	-18	4	5	2	2	3	-6	-11	14	15	10	14		
5,000	-3	-3	-2	-2	-2	-10	-14	2	2	1	1	2	-6	-10	13	13	9	12		
ATLANTA TO JACKSONVILLE																				
15,000	15	15	2	7	9	-1	-6	-18	-16	-3	-8	-10	-22	-28	17	17	241 N.MI.	16		
10,000	10	10	1	4	6	-3	-7	-12	-10	-1	-5	-6	-16	-21	14	14	9	13		
5,000	2	3	1	2	2	-5	-9	-3	-4	-1	-2	-2	-10	-14	13	12	9	11		
ATLANTA TO KNOXVILLE																				
15,000	11	3	1	4	4	-7	-13	-14	-6	-2	-5	-6	-18	-25	19	19	132 N.MI.	18		
10,000	6	3	2	3	3	-6	-11	-8	-4	-2	-4	-4	-13	-19	15	15	10	14		
5,000	3	2	1	1	2	-6	-11	-4	-3	-1	-1	-2	-10	-15	14	13	9	12		
ATLANTA TO LOUISVILLE																				
15,000	-6	-8	-3	-4	-5	-16	-22	1	6	2	2	3	-8	-14	19	19	279 N.MI.	18		
10,000	-5	-6	-2	-3	-4	-13	-18	3	4	1	2	2	-6	-11	14	15	10	14		
5,000	-3	-2	-1	-2	-2	-10	-14	2	1	1	1	1	-7	-11	14	13	9	12		
ATLANTA TO MACON																				
15,000	14	14	3	7	9	-2	-8	-17	-16	-4	-8	-10	-22	-29	19	19	70 N.MI.	18		
10,000	11	9	1	5	6	-3	-8	-12	-11	-2	-5	-7	-17	-22	15	15	10	14		
5,000	4	4	2	2	3	-5	-10	-4	-4	-2	-2	-3	-11	-15	14	13	9	12		
ATLANTA TO MELBOURNE																				
15,000	12	12	1	4	6	-3	-7	-15	-13	-1	-5	-7	-18	-25	16	16	386 N.MI.	14		
10,000	7	7	-1	2	3	-4	-9	-8	-8	0	-3	-4	-13	-17	13	13	9	12		
5,000	-1	1	0	0	0	-7	-11	0	-2	0	-1	0	-7	-11	12	11	8	11		
ATLANTA TO MEMPHIS																				
15,000	-34	-27	-8	-16	-19	-34	-42	32	26	8	15	18	7	1	19	18	288 N.MI.	17		
10,000	-24	-18	-6	-11	-14	-25	-31	24	18	6	11	14	4	-1	14	15	10	14		
5,000	-12	-10	-5	-5	-8	-16	-21	12	9	5	4	7	-1	-5	14	13	9	12		
ATLANTA TO MOBILE																				
15,000	-28	-20	-4	-12	-14	-28	-35	27	18	4	11	13	2	-3	17	17	263 N.MI.	16		
10,000	-19	-14	-6	-7	-11	-20	-26	19	13	5	7	10	2	-3	14	14	9	13		
5,000	-11	-9	-5	-4	-7	-15	-19	11	8	5	3	6	-1	-5	13	12	9	11		
ATLANTA TO MONTGOMERY																				
15,000	-30	-21	-6	-13	-16	-30	-38	29	20	5	12	15	3	-2	18	18	128 N.MI.	17		
10,000	-21	-15	-6	-9	-12	-22	-28	20	14	6	8	11	2	-3	14	15	10	14		
5,000	-12	-9	-5	-4	-7	-15	-20	11	9	5	4	7	-1	-5	13	13	9	12		

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT				
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
ATLANTA TO NASHVILLE																			186 N.MI.			
15,000	-19	-18	-5	-10	-12	-24	-32	15	16	5	9	10	-1	-6	19	19	11	18				
10,000	-15	-12	-4	-7	-9	-19	-24	13	11	4	6	8	-1	-6	15	15	10	14				
5,000	-8	-6	-4	-3	-5	-13	-18	7	5	3	3	4	-4	-8	14	13	9	12				
ATLANTA TO NEW ORLEANS																			369 N.MI.			
15,000	-30	-21	-4	-12	-15	-29	-36	28	20	4	11	14	3	-2	17	16	10	16				
10,000	-20	-15	-5	-7	-11	-21	-26	20	14	5	7	11	2	-2	13	14	9	13				
5,000	-12	-9	-5	-4	-7	-15	-19	11	8	5	4	7	-1	-5	13	12	8	11				
ATLANTA TO ORLANDO																			345 N.MI.			
15,000	11	11	1	4	6	-3	-8	-13	-12	-1	-5	-7	-18	-24	16	16	9	15				
10,000	6	7	-1	2	3	-5	-9	-8	-8	0	-3	-4	-12	-17	13	13	9	12				
5,000	-1	1	0	0	0	-7	-11	0	-2	0	-1	0	-7	-11	12	11	8	11				
ATLANTA TO RALEIGH																			309 N.MI.			
15,000	35	26	9	16	20	8	2	-37	-27	-9	-17	-21	-35	-43	18	18	10	18				
10,000	25	18	8	12	15	5	1	-25	-19	-8	-12	-15	-26	-32	14	15	10	14				
5,000	13	10	5	4	8	0	-4	-14	-10	-5	-5	-8	-16	-21	13	12	9	12				
ATLANTA TO ROME																			56 N.MI.			
15,000	-21	-19	-5	-10	-13	-25	-33	18	17	5	9	11	0	-6	19	19	11	18				
10,000	-16	-13	-3	-7	-9	-19	-25	14	12	3	6	8	-1	-6	15	15	10	14				
5,000	-7	-6	-3	-3	-5	-13	-17	6	5	3	3	4	-4	-8	14	13	9	12				
ATLANTA TO ST. PETERSBURG																			355 N.MI.			
15,000	4	5	0	1	2	-7	-12	-6	-7	0	-2	-3	-13	-18	16	16	9	15				
10,000	1	3	-2	0	0	-8	-12	-3	-4	2	-1	-1	-9	-14	13	13	9	12				
5,000	-3	-1	-2	-1	-2	-9	-13	3	1	2	0	1	-6	-9	12	11	8	11				
ATLANTA TO SAVANNAH																			193 N.MI.			
15,000	26	23	5	12	15	4	-2	-28	-24	-6	-12	-16	-29	-37	18	18	10	17				
10,000	19	15	4	8	11	1	-3	-20	-16	-4	-8	-11	-21	-27	14	15	10	13				
5,000	8	7	3	3	5	-2	-6	-8	-7	-4	-4	-6	-13	-18	13	12	9	12				
ATLANTA TO TALLAHASSEE																			195 N.MI.			
15,000	-5	-1	-1	-2	-2	-12	-17	2	-2	0	1	0	-10	-15	17	17	10	16				
10,000	-3	-1	-3	-1	-2	-11	-15	2	0	3	1	1	-7	-12	14	14	10	13				
5,000	-5	-3	-2	-1	-2	-10	-14	4	2	2	0	2	-5	-10	13	12	9	12				
ATLANTA TO TAMPA																			355 N.MI.			
15,000	5	6	0	1	2	-6	-11	-7	-8	0	-2	-4	-14	-19	16	16	9	15				
10,000	2	3	-2	0	1	-7	-11	-3	-4	2	-1	-1	-9	-14	13	13	9	12				
5,000	-3	-1	-2	-1	-2	-9	-12	3	1	1	0	1	-6	-10	12	11	8	11				
ATLANTIC CITY TO NEW YORK																			80 N.MI.			
15,000	21	11	8	14	13	0	-6	-25	-13	-9	-16	-15	-29	-36	22	22	13	20				
10,000	13	8	6	10	9	-1	-7	-15	-10	-7	-11	-10	-21	-27	18	18	12	15				
5,000	7	3	3	4	4	-4	-9	-8	-4	-4	-5	-5	-14	-19	15	15	11	13				
ATLANTIC CITY TO WASHINGTON, D.C.																			120 N.MI.			
15,000	-41	-29	-17	-24	-26	-41	-50	40	27	17	23	25	12	6	21	21	12	20				
10,000	-29	-22	-14	-18	-20	-31	-37	29	21	13	17	19	9	4	17	17	11	15				
5,000	-15	-12	-8	-9	-11	-20	-25	15	11	8	9	10	2	-3	15	14	10	13				
AUGUSTA, GA. TO CHARLESTON, S.C.																			101 N.MI.			
15,000	31	26	7	14	18	6	0	-33	-27	-7	-15	-18	-33	-41	18	18	10	17				
10,000	23	18	6	9	13	3	-1	-23	-18	-6	-10	-13	-24	-30	15	15	10	14				
5,000	10	9	5	4	7	-1	-5	-11	-9	-5	-4	-7	-15	-20	13	12	9	12				
AUGUSTA, GA. TO COLUMBIA																			55 N.MI.			
15,000	29	21	7	14	16	4	-1	-31	-22	-7	-14	-17	-31	-39	19	19	11	18				
10,000	20	15	7	10	12	3	-2	-21	-15	-7	-10	-13	-23	-29	15	15	10	14				
5,000	11	8	4	4	7	-1	-6	-12	-9	-5	-4	-7	-15	-20	14	13	9	12				
AUGUSTA, GA. TO JACKSONVILLE																			178 N.MI.			
15,000	-1	1	-1	-1	-1	-10	-16	-2	-4	1	0	-1	-11	-17	17	17	10	16				
10,000	-1	1	-2	-1	-1	-10	-14	0	-2	2	1	0	-8	-13	14	14	9	13				
5,000	-4	-2	-2	-1	-2	-9	-13	3	1	1	1	2	-6	-10	13	12	9	11				

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N								JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85						
AUGUSTA, GA. TO SAVANNAH																			91 N.MI.	
15,000	11	11	2	4	6	-4	-10	-14	-13	-2	-5	-8	-19	-26	18	18	10	17	15	14
10,000	8	8	1	2	4	-5	-9	-10	-9	-1	-3	-5	-15	-20	15	15	10			
5,000	1	2	1	1	1	-6	-10	-2	-3	-1	-1	-2	-10	-14	13	12	9	12		
AUGUSTA, ME. TO BANGOR																			50 N.MI.	
15,000	32	20	18	24	23	9	2	-34	-21	-19	-25	-24	-39	-47	23	22	15	22	18	16
10,000	23	12	12	16	15	4	-1	-24	-14	-13	-17	-16	-28	-34	18	18	13			
5,000	10	7	10	9	9	0	-5	-11	-8	-10	-10	-10	-19	-24	16	15	12	13		
AUGUSTA, ME. TO LEWISTON																			21 N.MI.	
15,000	-34	-22	-19	-25	-24	-39	-47	33	20	18	23	23	9	2	23	22	15	22	18	16
10,000	-24	-14	-13	-17	-16	-28	-34	23	13	12	16	15	5	-1	18	18	13			
5,000	-11	-8	-10	-10	-10	-19	-24	11	7	9	9	9	0	-6	16	16	12	13		
AUGUSTA, ME. TO ROCKLAND																			33 N.MI.	
15,000	28	22	20	20	22	9	1	-31	-23	-20	-22	-24	-38	-46	23	22	15	22	18	16
10,000	25	17	16	17	18	7	1	-26	-18	-16	-18	-19	-30	-37	18	18	13			
5,000	14	10	10	10	11	2	-4	-15	-10	-11	-11	-11	-21	-26	16	16	12	13		
AUSTIN TO DALLAS																			159 N.MI.	
15,000	11	8	4	2	6	-4	-9	-14	-10	-4	-3	-7	-18	-24	18	16	10	16	14	12
10,000	9	7	4	2	6	-3	-7	-11	-8	-4	-3	-6	-15	-19	14	13	10			
5,000	7	7	9	4	7	-1	-6	-7	-8	-9	-4	-7	-15	-19	14	13	9	12		
AUSTIN TO FT. WORTH																			156 N.MI.	
15,000	9	6	4	2	5	-5	-10	-12	-8	-4	-3	-6	-17	-22	18	16	10	16	14	12
10,000	8	7	4	2	5	-3	-8	-9	-7	-4	-2	-6	-14	-19	14	13	10			
5,000	6	7	9	4	7	-1	-6	-7	-7	-9	-4	-7	-15	-19	14	13	9	12		
AUSTIN TO HOUSTON																			132 N.MI.	
15,000	26	22	2	10	14	2	-3	-27	-22	-2	-10	-14	-27	-35	17	16	10	15	13	12
10,000	16	12	1	6	8	-1	-5	-17	-13	-1	-6	-9	-18	-23	13	13	10			
5,000	7	3	-1	2	2	-5	-9	-8	-4	0	-2	-3	-11	-15	14	12	8	12		
AUSTIN TO SAN ANGELO																			158 N.MI.	
15,000	-26	-21	-1	-10	-13	-27	-34	25	20	0	10	13	1	-4	17	16	10	15	13	12
10,000	-16	-12	-1	-6	-8	-17	-22	15	11	1	6	8	-1	-5	13	13	10			
5,000	-7	-2	2	-1	-1	-10	-14	6	2	-3	1	1	-7	-11	14	13	9	12		
AUSTIN TO SAN ANTONIO																			61 N.MI.	
15,000	-24	-19	-4	-7	-12	-24	-31	22	17	4	7	11	1	-4	17	16	10	15	13	12
10,000	-17	-13	-5	-5	-10	-19	-24	17	13	5	4	9	1	-4	13	13	10			
5,000	-11	-9	-8	-5	-8	-16	-20	10	9	8	5	8	0	-4	14	13	9	12		
AUSTIN TO WACO																			83 N.MI.	
15,000	12	9	4	3	6	-4	-9	-14	-10	-4	-3	-7	-18	-24	18	16	11	16	14	12
10,000	10	8	4	2	6	-2	-7	-11	-9	-5	-3	-7	-15	-20	14	13	10			
5,000	7	8	9	4	7	-1	-5	-8	-8	-9	-5	-8	-15	-20	14	13	9	12		
BAKERSFIELD TO FRESNO																			86 N.MI.	
15,000	-14	-10	0	-4	-6	-19	-26	13	9	0	3	5	-6	-12	22	19	11	17	16	13
10,000	-10	-9	1	-3	-4	-14	-19	9	8	-2	2	4	-5	-10	16	14	9			
5,000	-4	-4	-2	-4	-4	-10	-13	3	4	2	4	3	-3	-6	11	9	7	9		
BAKERSFIELD TO LOS ANGELES																			96 N.MI.	
15,000	12	8	-1	2	4	-7	-12	-13	-9	1	-3	-5	-17	-24	21	18	11	16	16	12
10,000	8	8	-2	2	3	-5	-10	-9	-9	2	-2	-4	-13	-18	16	14	9			
5,000	4	5	1	3	3	-3	-6	-5	-5	-1	-3	-3	-9	-13	11	9	7	9		
BAKERSFIELD TO VISALIA																			56 N.MI.	
15,000	-13	-9	0	-3	-5	-18	-25	11	7	-1	3	4	-7	-13	22	19	11	17	16	13
10,000	-9	-8	2	-2	-4	-13	-19	8	7	-2	2	3	-6	-10	16	14	9			
5,000	-4	-4	-2	-4	-3	-9	-13	3	4	2	4	3	-3	-6	11	9	7	9		
BALTIMORE TO BOSTON																			321 N.MI.	
15,000	34	22	15	21	22	10	3	-37	-23	-16	-23	-23	-37	-45	21	20	13	19	17	15
10,000	24	16	11	16	16	6	1	-25	-18	-12	-17	-17	-28	-34	17	17	11			
5,000	12	8	7	8	9	0	-4	-13	-9	-7	-9	-9	-18	-23	14	14	10	12		

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HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
BALTIMORE TO BUFFALO																		
15,000	-17	-15	-8	-7	-11	-24	-31	12	13	7	5	9	-3	-10	21	21	245 N.MI.	20
10,000	-13	-12	-8	-7	-10	-20	-26	10	10	7	6	8	-1	-7	16	17	12	15
5,000	-7	-7	-5	-4	-5	-14	-19	6	6	4	3	5	-4	-8	14	14	10	12
BALTIMORE TO CHARLOTTE																		
15,000	-31	-19	-9	-17	-18	-31	-39	28	17	9	16	16	5	-1	19	19	313 N.MI.	18
10,000	-20	-14	-7	-12	-13	-23	-28	18	13	7	11	12	2	-3	15	16	10	14
5,000	-10	-7	-4	-5	-6	-15	-19	10	7	4	5	6	-2	-6	14	13	9	12
BALTIMORE TO DETROIT																		
15,000	-37	-27	-16	-20	-24	-37	-45	35	25	16	18	22	10	4	20	20	355 N.MI.	19
10,000	-26	-20	-14	-17	-19	-29	-35	25	19	14	16	18	8	3	16	16	11	14
5,000	-14	-11	-8	-9	-10	-19	-23	13	11	8	8	10	2	-3	14	14	9	12
BALTIMORE TO HARRISBURG																		
15,000	-6	-9	-3	0	-4	-17	-24	1	6	2	-2	1	-11	-18	22	22	64 N.MI.	20
10,000	-5	-6	-4	-2	-4	-15	-20	3	5	3	1	3	-7	-13	17	18	12	15
5,000	-3	-4	-2	-2	-3	-11	-16	2	3	2	1	2	-7	-12	15	15	10	13
BALTIMORE TO LANCASTER																		
15,000	12	4	5	10	7	-5	-12	-17	-7	-6	-12	-10	-23	-30	22	22	59 N.MI.	20
10,000	7	3	2	6	5	-6	-11	-10	-5	-3	-7	-6	-17	-23	17	18	12	15
5,000	4	1	1	3	2	-6	-11	-5	-2	-2	-3	-3	-12	-17	15	15	10	13
BALTIMORE TO MONTREAL																		
15,000	14	5	5	10	8	-4	-10	-18	-8	-7	-12	-11	-23	-30	21	20	399 N.MI.	19
10,000	8	3	3	6	5	-5	-10	-11	-5	-4	-8	-6	-16	-22	16	16	11	14
5,000	4	1	2	4	3	-6	-10	-5	-2	-3	-4	-3	-12	-16	14	14	10	12
BALTIMORE TO NEW YORK																		
15,000	36	23	15	22	23	10	4	-38	-25	-16	-23	-24	-39	-47	21	21	159 N.MI.	20
10,000	25	18	12	16	17	7	1	-26	-19	-12	-17	-18	-29	-35	17	17	12	15
5,000	13	9	7	8	9	0	-4	-14	-10	-7	-8	-9	-18	-23	15	15	10	13
BALTIMORE TO NORFOLK																		
15,000	1	5	2	-2	2	-10	-17	-6	-8	-3	0	-4	-16	-23	21	20	138 N.MI.	19
10,000	3	4	2	0	2	-7	-13	-6	-5	-3	-1	-4	-14	-19	17	17	11	15
5,000	2	3	1	1	2	-7	-11	-3	-3	-2	-1	-2	-11	-15	14	14	10	13
BALTIMORE TO PHILADELPHIA																		
15,000	36	23	15	22	22	10	3	-38	-25	-16	-23	-24	-39	-47	22	21	79 N.MI.	20
10,000	25	18	11	16	17	6	1	-26	-19	-12	-17	-18	-29	-35	17	18	12	15
5,000	13	9	7	8	9	0	-4	-14	-10	-7	-8	-9	-18	-24	15	15	10	13
BALTIMORE TO PITTSBURGH																		
15,000	-39	-29	-17	-21	-25	-40	-48	37	27	16	19	24	11	5	21	21	182 N.MI.	20
10,000	-28	-22	-14	-18	-20	-31	-37	27	21	14	17	19	9	4	16	17	12	15
5,000	-15	-12	-8	-9	-11	-19	-24	14	12	8	9	10	2	-3	14	14	10	12
BALTIMORE TO PROVIDENCE																		
15,000	36	23	16	22	23	11	4	-38	-25	-17	-23	-24	-38	-46	21	21	284 N.MI.	19
10,000	25	18	12	16	17	7	2	-26	-19	-13	-17	-18	-29	-35	17	17	11	15
5,000	13	9	7	8	9	1	-4	-14	-10	-8	-9	-10	-18	-23	14	14	10	12
BALTIMORE TO RICHMOND																		
15,000	-17	-8	-5	-11	-10	-23	-30	13	5	5	10	7	-4	-11	21	21	105 N.MI.	19
10,000	-10	-6	-3	-7	-6	-17	-22	8	4	3	6	5	-5	-10	17	17	11	15
5,000	-5	-3	-2	-3	-3	-12	-16	4	2	2	2	2	-6	-11	15	14	10	13
BALTIMORE TO ROCHESTER, N.Y.																		
15,000	-8	-10	-5	-2	-6	-18	-25	3	7	4	0	4	-9	-16	21	21	241 N.MI.	20
10,000	-7	-8	-5	-4	-6	-16	-21	4	6	5	2	4	-6	-11	17	17	12	15
5,000	-4	-5	-3	-2	-3	-12	-16	3	4	3	1	3	-6	-11	14	14	10	12
BALTIMORE TO SYRACUSE																		
15,000	4	-2	1	5	2	-10	-17	-9	-1	-2	-7	-5	-17	-24	21	21	238 N.MI.	20
10,000	2	-1	-1	2	0	-10	-15	-4	0	0	-4	-2	-12	-18	17	17	12	15
5,000	1	-1	0	1	0	-8	-13	-2	0	0	-2	-1	-9	-14	14	14	10	12

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BALTIMORE TO WASHINGTON, D.C.																		
15,000	-32	-19	-12	-19	-19	-33	-42	29	17	11	18	17	5	-2	22	21	26 N.MI.	13 20
10,000	-21	-14	-9	-14	-14	-25	-31	19	13	8	13	13	2	-3	17	18	12 15	
5,000	-11	-7	-5	-6	-7	-16	-21	10	7	5	6	7	-2	-7	15	15	10 13	
BALTIMORE TO WILMINGTON, DEL.																		
15,000	36	23	15	22	23	10	3	-38	-25	-16	-23	-24	-39	-47	22	21	58 N.MI.	13 20
10,000	25	18	12	16	17	7	1	-27	-19	-12	-17	-18	-29	-35	17	18	12 15	
5,000	13	9	7	8	9	0	-4	-14	-10	-7	-8	-9	-19	-24	15	15	10 13	
BANGOR TO BOSTON																		
15,000	-27	-15	-13	-19	-18	-32	-39	24	13	11	17	16	3	-4	22	22	174 N.MI.	14 21
10,000	-17	-9	-8	-12	-11	-22	-28	15	8	7	11	10	-1	-6	18	18	12 15	
5,000	-7	-5	-7	-7	-6	-15	-20	6	4	6	6	6	-4	-9	15	15	11 13	
BANGOR TO HOULTON																		
15,000	20	11	10	15	14	0	-7	-23	-13	-11	-17	-16	-30	-38	23	22	90 N.MI.	15 21
10,000	13	5	5	9	8	-3	-9	-15	-7	-6	-10	-9	-20	-26	18	18	13 16	
5,000	5	3	6	6	5	-5	-10	-6	-4	-6	-6	-6	-15	-20	16	15	12 13	
BANGOR TO PORTLAND, ME.																		
15,000	-30	-18	-16	-22	-21	-35	-43	28	16	15	20	19	6	-1	23	22	94 N.MI.	15 21
10,000	-20	-11	-10	-14	-14	-25	-31	19	10	9	13	12	2	-4	18	18	12 16	
5,000	-9	-6	-8	-8	-8	-17	-22	8	6	8	8	7	-2	-7	16	15	12 13	
BANGOR TO PRESQUE ISLE																		
15,000	13	6	5	10	8	-5	-12	-17	-8	-7	-12	-10	-24	-32	23	22	117 N.MI.	15 21
10,000	7	2	2	5	4	-7	-13	-9	-3	-3	-6	-5	-16	-22	18	17	13 16	
5,000	1	1	3	3	2	-7	-12	-2	-2	-4	-4	-3	-12	-17	16	15	12 13	
BATON ROUGE TO LAFAYETTE																		
15,000	-30	-23	-4	-11	-16	-29	-37	29	22	3	11	15	3	-2	17	17	48 N.MI.	11 16
10,000	-20	-15	-4	-6	-11	-21	-26	20	15	4	6	10	1	-4	14	14	10 13	
5,000	-11	-8	-5	-4	-7	-15	-20	11	8	4	4	7	-1	-6	14	13	9 12	
BATON ROUGE TO LAKE CHARLES																		
15,000	-31	-24	-4	-12	-16	-30	-38	30	24	4	11	16	4	-1	17	17	106 N.MI.	10 16
10,000	-21	-15	-3	-7	-11	-21	-27	20	15	3	7	10	1	-3	14	14	10 13	
5,000	-11	-8	-4	-4	-6	-15	-19	10	7	4	4	6	-2	-6	13	13	9 12	
BATON ROUGE TO NEW ORLEANS																		
15,000	21	19	4	10	12	2	-4	-23	-20	-4	-10	-13	-25	-32	17	17	57 N.MI.	11 16
10,000	14	10	0	6	7	-2	-7	-15	-11	0	-7	-8	-17	-23	14	14	10 13	
5,000	5	3	0	3	3	-5	-9	-5	-4	-1	-3	-3	-11	-15	13	13	9 12	
BEAUMONT TO HOUSTON																		
15,000	-30	-24	-4	-11	-16	-29	-36	29	23	4	10	15	4	-2	17	16	68 N.MI.	10 16
10,000	-20	-15	-3	-6	-10	-20	-26	19	15	3	6	10	1	-3	14	13	10 13	
5,000	-11	-8	-4	-4	-6	-14	-19	10	7	4	4	6	-2	-6	14	12	9 12	
BEAUMONT TO LAKE CHARLES																		
15,000	29	23	4	10	15	3	-2	-30	-23	-4	-11	-16	-29	-37	17	16	47 N.MI.	11 16
10,000	20	15	3	6	10	1	-3	-20	-15	-4	-6	-11	-21	-26	14	14	10 13	
5,000	11	8	5	4	6	-1	-6	-11	-8	-5	-5	-7	-15	-20	14	13	9 12	
BEAUMONT TO SHREVEPORT																		
15,000	6	2	1	0	2	-8	-13	-8	-4	-1	-1	-3	-14	-19	17	17	150 N.MI.	10 16
10,000	5	4	4	0	3	-5	-10	-6	-5	-4	-1	-4	-12	-17	14	13	10 13	
5,000	5	5	6	2	5	-3	-8	-6	-6	-6	-2	-5	-13	-17	13	13	9 12	
BIG SPRINGS TO MIOLANO																		
15,000	-28	-23	-5	-11	-15	-28	-36	27	22	5	10	15	3	-2	19	17	38 N.MI.	11 16
10,000	-19	-15	-5	-7	-11	-20	-25	18	14	5	7	10	2	-3	14	13	10 12	
5,000	-9	-7	-6	-4	-6	-14	-18	8	7	6	3	6	-2	-6	13	13	9 11	
BILLINGS TO BISMARCK																		
15,000	24	15	18	21	20	9	3	-25	-16	-19	-22	-20	-31	-37	17	17	328 N.MI.	13 16
10,000	18	10	12	14	13	5	1	-18	-10	-12	-14	-14	-22	-26	13	12	10 12	
5,000	13	5	5	8	7	-1	-5	-13	-5	-5	-8	-8	-16	-20	12	12	10 12	

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*												STANDARD DEVIATION					
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
BILLINGS TO BOZEMAN																		
15,000	-26	-16	-17	-20	-20	-31	-37	25	15	17	19	19	8	2	18	17	13	17
10,000	-19	-11	-9	-15	-13	-22	-26	19	11	9	15	13	5	1	13	12	10	11
5,000	-14	-6	-5	-6	-7	-15	-19	13	6	5	6	7	0	-4	12	11	9	11
BILLINGS TO CASPER																		
15,000	18	10	5	12	11	0	-6	-19	-11	-6	-13	-12	-23	-30	18	17	13	17
10,000	14	7	3	9	8	0	-4	-14	-8	-4	-9	-8	-17	-21	13	12	10	12
5,000	0	2	0	1	1	-6	-10	0	-2	0	-1	-1	-8	-12	11	11	9	11
BILLINGS TO GREAT FALLS																		
15,000	-26	-14	-12	-18	-17	-29	-35	25	13	11	18	16	5	0	18	17	13	16
10,000	-19	-10	-7	-14	-12	-21	-25	19	10	7	14	12	4	0	13	12	10	11
5,000	-7	-4	-3	-4	-4	-12	-16	6	4	3	4	4	-3	-7	12	11	10	11
BILLINGS TO SHERIDAN																		
15,000	24	14	11	18	16	5	-1	-25	-15	-12	-19	-17	-29	-36	18	18	13	17
10,000	19	10	7	13	12	3	-1	-19	-10	-7	-14	-12	-21	-26	13	12	10	12
5,000	7	5	3	4	5	-3	-7	-8	-5	-3	-5	-5	-13	-17	12	11	10	11
BINGHAMPTON TO PITTSBURGH																		
15,000	-38	-23	-17	-24	-24	-39	-47	36	21	16	23	23	10	4	21	21	13	20
10,000	-27	-17	-13	-18	-18	-29	-35	26	16	12	17	17	7	2	17	17	12	15
5,000	-14	-9	-7	-9	-10	-19	-24	14	9	7	9	9	1	-4	14	15	10	12
BINGHAMPTON TO SCRANTON																		
15,000	4	7	4	1	4	-9	-16	-8	-10	-6	-3	-7	-20	-27	22	22	14	21
10,000	5	6	5	3	5	-6	-12	-8	-8	-6	-4	-6	-17	-23	18	18	12	16
5,000	3	4	3	2	3	-6	-11	-4	-5	-3	-2	-4	-13	-18	15	15	11	13
BINGHAMPTON TO SYRACUSE																		
15,000	-4	-7	-4	-1	-4	-17	-24	-1	4	3	-1	1	-12	-19	22	22	14	21
10,000	-4	-6	-4	-2	-4	-15	-21	2	4	4	1	3	-8	-14	18	18	12	16
5,000	-3	-4	-2	-1	-2	-11	-16	2	3	2	0	2	-7	-12	15	15	11	13
BIRMINGHAM TO CHARLOTTE																		
15,000	36	26	8	16	20	8	2	-37	-27	-8	-17	-20	-35	-44	18	18	10	17
10,000	26	18	7	11	15	5	1	-26	-19	-8	-12	-15	-26	-32	14	15	10	14
5,000	13	10	5	4	8	0	-4	-14	-11	-6	-5	-8	-17	-21	13	12	9	12
BIRMINGHAM TO CHATTANOOGA																		
15,000	27	17	5	11	14	2	-4	-29	-19	-6	-12	-15	-29	-37	19	19	11	18
10,000	19	12	6	8	11	1	-4	-20	-13	-6	-9	-11	-22	-27	15	15	10	14
5,000	10	8	4	3	6	-2	-6	-11	-8	-4	-3	-6	-15	-20	14	13	9	12
BIRMINGHAM TO GREENSBORO																		
15,000	36	25	8	16	20	8	2	-37	-27	-9	-17	-20	-35	-43	18	18	10	17
10,000	25	18	8	12	15	5	1	-26	-19	-8	-12	-15	-26	-32	14	15	10	14
5,000	13	10	5	5	8	0	-4	-14	-10	-5	-5	-8	-16	-21	13	12	9	12
BIRMINGHAM TO HUNTSVILLE																		
15,000	9	2	1	2	3	-8	-14	-12	-5	-1	-4	-5	-16	-23	19	19	11	18
10,000	5	2	2	2	3	-6	-11	-7	-3	-3	-2	-4	-13	-18	15	15	10	14
5,000	4	3	2	1	2	-6	-11	-5	-3	-2	-1	-3	-11	-15	14	14	9	12
BIRMINGHAM TO JACKSON																		
15,000	-34	-24	-6	-14	-18	-33	-41	33	23	5	14	17	5	-1	18	18	10	17
10,000	-24	-17	-6	-9	-13	-24	-30	23	16	6	9	13	3	-1	14	14	10	14
5,000	-13	-10	-5	-4	-8	-16	-21	12	10	5	4	7	-1	-5	14	13	9	12
BIRMINGHAM TO KNOXVILLE																		
15,000	30	19	6	13	15	4	-2	-32	-21	-6	-14	-16	-31	-39	19	19	11	18
10,000	20	14	6	9	12	2	-3	-22	-15	-6	-10	-12	-23	-28	14	15	10	14
5,000	11	8	4	3	6	-2	-6	-12	-9	-5	-4	-7	-15	-20	14	13	9	12
BIRMINGHAM TO MEMPHIS																		
15,000	-30	-24	-7	-15	-17	-31	-39	28	23	7	14	16	5	-1	19	19	11	18
10,000	-21	-17	-5	-10	-13	-23	-29	20	16	5	10	12	2	-2	14	15	10	14
5,000	-11	-8	-4	-4	-7	-15	-20	10	8	4	4	6	-2	-6	14	14	9	12

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*										STANDARD DEVIATION			
	D I R E C T					R E T U R N					JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85
BIRMINGHAM TO MERIDIAN														
15,000	-36	-27	-7	-16	-20	-35	-43	35	26	7	15	19	6	1
10,000	-25	-18	-6	-11	-14	-25	-31	25	18	6	10	14	4	-1
5,000	-13	-10	-5	-5	-8	-17	-22	13	10	5	4	8	-1	-5
BIRMINGHAM TO MOBILE														
15,000	-19	-11	-2	-7	-8	-20	-27	16	9	2	6	7	-3	-8
10,000	-13	-8	-5	-4	-7	-16	-21	12	7	5	3	6	-2	-7
5,000	-9	-7	-4	-2	-5	-13	-18	8	6	4	2	5	-3	-7
BIRMINGHAM TO MONTGOMERY														
15,000	1	5	2	2	2	-8	-14	-4	-7	-2	-3	-4	-15	-21
10,000	1	3	-2	2	1	-8	-13	-3	-4	1	-2	-2	-11	-16
5,000	-1	-1	-1	1	-1	-9	-13	1	0	1	-1	0	-8	-12
BIRMINGHAM TO MUSCLE SHOALS														
15,000	-15	-15	-4	-8	-10	-22	-29	12	13	4	7	8	-3	-8
10,000	-11	-10	-2	-6	-7	-17	-22	10	9	2	5	6	-3	-8
5,000	-5	-4	-2	-3	-3	-12	-16	4	3	2	2	3	-5	-10
BIRMINGHAM TO NEW ORLEANS														
15,000	-26	-17	-3	-10	-12	-25	-32	24	15	2	9	11	0	-5
10,000	-17	-12	-5	-6	-10	-19	-24	17	11	5	5	9	0	-4
5,000	-11	-8	-5	-3	-6	-14	-19	10	8	4	3	6	-2	-6
BIRMINGHAM TO PENSACOLA														
15,000	-10	-4	0	-3	-4	-15	-21	7	2	0	2	2	-8	-13
10,000	-7	-4	-4	-2	-4	-12	-17	5	3	4	1	3	-5	-10
5,000	-6	-4	-3	-1	-4	-11	-16	5	4	3	1	3	-5	-9
BISBEE TO EL PASO														
15,000	25	21	3	9	13	2	-3	-26	-22	-3	-10	-14	-26	-34
10,000	15	13	3	5	8	1	-3	-15	-13	-3	-6	-9	-17	-22
5,000	0	1	0	-4	-1	-6	-9	-1	-1	0	4	1	-5	-8
BISBEE TO TUCSON														
15,000	-21	-17	1	-7	-10	-22	-30	20	17	-2	6	9	-2	-7
10,000	-12	-10	1	-3	-5	-14	-19	12	10	-1	2	5	-3	-7
5,000	4	3	3	5	4	-1	-4	-4	-3	-3	-5	-4	-9	-12
BISMARCK TO FARGO														
15,000	26	17	20	23	21	10	4	-27	-18	-20	-24	-22	-34	-40
10,000	20	10	14	15	15	6	0	-20	-11	-14	-16	-15	-25	-30
5,000	10	4	5	9	7	-2	-7	-11	-4	-6	-9	-8	-17	-22
BISMARCK TO JAMESTOWN														
15,000	26	16	20	23	21	9	3	-27	-17	-20	-24	-22	-33	-40
10,000	19	10	14	14	14	5	0	-20	-10	-14	-15	-15	-24	-29
5,000	10	4	5	8	7	-3	-8	-10	-4	-5	-9	-7	-17	-22
BISMARCK TO MINNEAPOLIS														
15,000	28	19	19	24	22	11	5	-29	-20	-20	-25	-23	-35	-41
10,000	22	13	14	16	16	7	2	-23	-13	-15	-17	-17	-26	-31
5,000	12	5	5	10	8	-1	-5	-13	-6	-6	-11	-9	-18	-22
BOISE TO PENDLETON														
15,000	-22	-12	-9	-15	-14	-26	-33	20	11	8	14	12	1	-5
10,000	-14	-7	-4	-9	-8	-17	-22	13	7	4	8	8	-1	-5
5,000	0	-3	-4	0	-2	-8	-11	-1	2	4	0	2	-5	-9
BOISE TO PORTLAND, ORE.														
15,000	-26	-16	-13	-20	-18	-30	-37	25	15	13	19	17	6	-1
10,000	-17	-11	-7	-11	-11	-20	-25	16	10	7	11	11	2	-2
5,000	-3	-4	-3	-2	-3	-9	-12	2	4	3	2	3	-3	-7
BOISE TO RENO														
15,000	-10	-8	-12	-9	-10	-21	-27	8	7	11	8	9	-3	-9
10,000	-7	-5	-7	-6	-6	-14	-19	6	5	7	5	6	-2	-7
5,000	-6	-5	1	-5	-3	-10	-13	6	5	-1	5	3	-3	-6

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	O I R E C T							R E T U R N										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
BOISE TO SALT LAKE CITY																		
15,000	20	12	8	13	13	2	-4	-21	-13	-9	-14	-14	-25	-32	19	17	12	17
10,000	13	8	4	8	8	0	-4	-14	-8	-4	-9	-8	-17	-21	13	12	9	12
5,000	-3	0	-1	-2	-1	-7	-10	3	0	0	1	1	-4	-7	9	8	6	8
BOISE TO SEATTLE																		
15,000	-23	-13	-10	-16	-15	-27	-34	21	12	9	15	14	2	-4	19	19	13	18
10,000	-14	-8	-5	-10	-9	-18	-23	13	8	5	9	8	0	-4	14	13	10	13
5,000	-1	-3	-4	0	-2	-8	-12	0	3	4	0	2	-4	-8	11	9	7	10
BOSTON TO BUFFALO																		
15,000	-39	-27	-21	-25	-27	-41	-48	38	26	21	24	26	14	7	21	20	13	19
10,000	-29	-20	-16	-19	-21	-31	-37	29	20	16	19	20	10	5	16	17	11	15
5,000	-16	-12	-10	-11	-12	-21	-26	15	11	10	10	12	3	-2	14	14	10	12
BOSTON TO BURLINGTON																		
15,000	-20	-17	-14	-13	-16	-29	-36	16	15	13	11	14	1	-6	22	22	14	21
10,000	-18	-14	-12	-11	-14	-24	-30	16	13	11	10	12	2	-4	18	18	12	16
5,000	-11	-8	-7	-7	-8	-17	-22	10	8	7	6	7	-2	-6	15	15	11	13
BOSTON TO CONCORD																		
15,000	-13	-13	-10	-8	-11	-24	-31	8	11	8	6	8	-5	-12	23	22	14	21
10,000	-13	-11	-9	-7	-10	-21	-27	11	10	8	6	8	-2	-8	18	18	12	16
5,000	-8	-7	-5	-5	-6	-15	-21	7	6	4	4	5	-4	-9	16	15	11	13
BOSTON TO FITCHBURG																		
15,000	-36	-27	-21	-23	-26	-40	-48	34	26	20	22	25	11	4	23	22	14	21
10,000	-28	-21	-16	-18	-20	-32	-38	27	20	16	17	20	9	3	18	18	12	16
5,000	-15	-12	-10	-11	-12	-22	-27	15	11	10	10	11	2	-3	16	15	11	13
BOSTON TO HARTFORD																		
15,000	-38	-25	-19	-24	-26	-40	-48	36	24	18	23	24	11	4	22	22	14	21
10,000	-27	-19	-14	-18	-19	-30	-36	26	18	13	17	18	7	2	18	18	12	16
5,000	-14	-10	-9	-10	-11	-20	-25	13	9	9	9	10	1	-4	15	15	11	13
BOSTON TO HYANNIS																		
15,000	16	16	12	11	14	1	-6	-20	-19	-13	-13	-16	-29	-37	23	22	14	21
10,000	17	14	11	9	12	2	-4	-19	-15	-11	-10	-13	-25	-31	18	18	12	16
5,000	10	9	6	6	8	-2	-7	-11	-9	-7	-7	-8	-18	-23	16	15	11	13
BOSTON TO LEBANON																		
15,000	-20	-18	-14	-13	-16	-29	-37	17	16	13	11	14	1	-6	23	22	14	21
10,000	-19	-14	-12	-11	-14	-25	-31	17	13	11	10	13	2	-4	18	18	12	16
5,000	-11	-9	-7	-7	-8	-18	-23	10	8	7	6	8	-2	-7	16	15	11	13
BOSTON TO LEWISTON																		
15,000	16	7	6	11	10	-3	-11	-20	-10	-8	-13	-12	-26	-34	23	22	14	21
10,000	8	3	3	7	5	-5	-11	-11	-5	-4	-8	-7	-17	-23	18	18	12	16
5,000	3	1	3	3	3	-6	-12	-4	-2	-4	-4	-3	-13	-18	16	15	11	13
BOSTON TO MANCHESTER																		
15,000	-16	-15	-11	-10	-13	-26	-34	12	13	10	8	11	-3	-10	23	22	14	21
10,000	-15	-13	-10	-9	-11	-22	-28	13	11	9	8	10	-1	-6	18	18	12	16
5,000	-9	-8	-6	-6	-7	-16	-22	8	7	5	5	6	-3	-8	16	15	12	13
BOSTON TO MONTREAL																		
15,000	-18	-16	-13	-12	-14	-27	-35	14	13	12	10	12	-1	-8	22	21	14	20
10,000	-16	-13	-11	-11	-12	-23	-29	14	12	10	9	11	1	-5	17	17	12	15
5,000	-10	-8	-7	-6	-7	-17	-22	9	7	6	5	7	-2	-7	15	15	11	13
BOSTON TO NEW BEDFORD																		
15,000	-7	0	0	-4	-2	-16	-23	2	-3	-2	2	0	-13	-20	23	22	14	21
10,000	0	2	1	-2	0	-10	-16	-2	-3	-2	0	-2	-13	-19	18	18	12	16
5,000	1	2	0	0	1	-8	-13	-2	-3	-1	-1	-2	-11	-16	16	15	11	13
BOSTON TO NEW YORK																		
15,000	-35	-22	-16	-22	-23	-37	-45	33	21	15	21	21	9	2	22	21	13	20
10,000	-24	-16	-12	-16	-16	-27	-34	22	15	11	15	15	5	0	17	18	12	15
5,000	-12	-8	-8	-8	-9	-18	-23	11	8	7	8	8	0	-5	15	15	11	13

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**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*													STANDARD DEVIATION							
	DIRECT							RETURN							JAN	APR	JUL	OCT			
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85							
BOSTON TO PHILADELPHIA																		242 N.MI.			
15,000	-36	-23	-16	-22	-23	-37	-45	34	21	15	21	22	9	3	21	21	13	20			
10,000	-25	-17	-12	-16	-17	-28	-34	23	16	11	16	16	6	0	17	17	12	15			
5,000	-13	-9	-8	-9	-9	-18	-23	12	8	7	8	9	0	-5	15	15	10	13			
BOSTON TO PORTLAND, ME.																		83 N.MI.			
15,000	18	8	7	12	11	-2	-10	-21	-11	-8	-14	-13	-27	-35	23	22	14	21			
10,000	9	4	4	7	6	-4	-10	-12	-6	-5	-9	-8	-18	-25	18	18	12	16			
5,000	4	2	4	4	3	-6	-11	-5	-3	-4	-4	-4	-13	-18	16	15	11	13			
BOSTON TO PROVIDENCE																		43 N.MI.			
15,000	-25	-14	-10	-16	-15	-29	-37	21	11	9	14	13	0	-7	23	22	14	21			
10,000	-15	-9	-7	-11	-10	-21	-27	12	7	6	9	8	-2	-8	18	18	12	16			
5,000	-7	-4	-5	-5	-5	-14	-20	6	3	4	5	4	-5	-10	16	15	11	13			
BOSTON TO SYRACUSE																		230 N.MI.			
15,000	-38	-27	-21	-24	-27	-41	-48	36	26	21	23	26	13	6	22	21	14	20			
10,000	-29	-20	-16	-19	-21	-32	-38	28	20	16	18	20	10	4	17	17	12	15			
5,000	-16	-12	-10	-11	-12	-21	-26	15	11	10	10	12	3	-2	15	15	11	13			
BOSTON TO WASHINGTON, D.C.																		346 N.MI.			
15,000	-36	-23	-16	-22	-23	-37	-45	34	21	15	21	22	10	3	21	20	12	19			
10,000	-25	-17	-12	-16	-17	-27	-33	23	16	11	15	16	6	1	16	17	11	14			
5,000	-13	-9	-7	-8	-9	-18	-22	12	8	7	8	8	0	-4	14	14	10	12			
BOSTON TO WORCESTER																		39 N.MI.			
15,000	-40	-28	-21	-26	-28	-42	-50	38	27	21	25	27	13	6	23	22	14	21			
10,000	-30	-21	-16	-19	-21	-32	-39	29	20	16	19	20	9	4	18	18	12	16			
5,000	-16	-12	-11	-11	-12	-22	-27	15	11	10	11	11	2	-3	16	15	11	13			
BOWLING GREEN TO LOUISVILLE																		80 N.MI.			
15,000	17	9	5	8	9	-3	-9	-21	-11	-6	-9	-11	-24	-31	20	20	12	20			
10,000	12	7	4	6	7	-3	-8	-14	-8	-5	-7	-8	-18	-24	15	16	11	15			
5,000	6	4	3	3	4	-5	-9	-7	-5	-3	-3	-4	-13	-18	15	14	10	13			
BOWLING GREEN TO NASHVILLE																		52 N.MI.			
15,000	-16	-8	-3	-6	-7	-20	-27	12	5	3	4	6	-6	-12	20	20	12	19			
10,000	-10	-5	-3	-4	-6	-15	-21	8	4	3	4	4	-5	-10	15	16	11	15			
5,000	-5	-4	-2	-2	-3	-12	-16	4	3	* 2	1	2	-6	-11	15	14	10	13			
BOZEMAN TO BUTTE																		57 N.MI.			
15,000	-27	-16	-16	-21	-20	-32	-38	26	16	16	20	19	8	2	19	18	13	17			
10,000	-20	-12	-9	-15	-13	-22	-27	19	11	9	15	13	5	1	13	12	10	12			
5,000	-11	-6	-5	-5	-6	-14	-18	10	5	4	5	6	-1	-5	12	11	9	11			
BRISTOL TO CHARLESTON, W. VA.																		119 N.MI.			
15,000	14	6	4	8	7	-4	-10	-18	-9	-5	-10	-10	-22	-29	20	20	12	19			
10,000	9	5	3	6	5	-4	-10	-11	-6	-3	-7	-6	-16	-22	16	16	11	15			
5,000	5	3	1	2	3	-6	-10	-6	-3	-2	-3	-3	-11	-16	14	14	9	12			
BRISTOL TO KNOXVILLE																		87 N.MI.			
15,000	-37	-26	-10	-18	-21	-36	-45	36	24	10	17	20	8	1	20	20	11	19			
10,000	-26	-18	-9	-13	-16	-27	-33	25	18	9	13	15	5	0	15	16	11	15			
5,000	-14	-10	-6	-6	-8	-17	-22	13	10	5	5	8	0	-5	14	14	9	13			
BUFFALO TO CHICAGO																		410 N.MI.			
15,000	-39	-25	-19	-24	-26	-39	-46	37	23	19	23	25	13	6	20	20	13	19			
10,000	-28	-18	-15	-18	-19	-30	-35	27	18	14	18	19	9	4	15	16	11	14			
5,000	-15	-10	-8	-11	-11	-20	-24	15	9	8	10	10	2	-2	14	14	10	12			
BROWNSVILLE TO CORPUS CHRISTI																		93 N.MI.			
15,000	7	4	5	4	5	-3	-8	-9	-5	-5	-4	-6	-14	-19	15	14	9	13			
10,000	6	5	6	5	5	-2	-5	-7	-6	-6	-5	-6	-13	-17	12	11	9	11			
5,000	9	10	9	4	8	1	-3	-10	-10	-9	-4	-8	-15	-19	13	11	8	11			
BRUNSWICK TO JACKSONVILLE																		46 N.MI.			
15,000	-11	-8	-3	-6	-6	-17	-23	9	6	3	5	5	-4	-9	17	17	10	16			
10,000	-9	-6	-4	-4	-6	-14	-19	8	5	4	4	5	-4	-8	14	14	9	13			
5,000	-7	-5	-3	-3	-4	-12	-16	7	5	3	2	4	-3	-7	12	12	9	12			

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION			
	O I R E C T							R E T U R N										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
BRUNSWICK TO SAVANNAH																		
15,000	8	5	3	5	5	-5	-10	-11	-7	-3	-6	-6	-17	-23	18	18	10	16
10,000	7	4	4	4	5	-4	-9	-9	-5	-4	-4	-5	-14	-19	14	15	10	13
5,000	7	4	3	2	4	-4	-8	-7	-5	-3	-2	-4	-12	-16	13	12	9	12
BUFFALO TO CLEVELAND																		
15,000	-35	-20	-16	-22	-22	-36	-44	33	18	15	21	21	8	2	21	21	13	20
10,000	-25	-15	-12	-17	-17	-28	-34	24	14	11	16	16	5	0	17	17	12	15
5,000	-14	-8	-7	-9	-9	-18	-23	13	8	6	9	9	0	-5	15	15	10	13
BUFFALO TO DETROIT																		
15,000	-39	-24	-19	-24	-26	-40	-48	38	23	19	23	25	12	6	21	21	13	20
10,000	-28	-18	-15	-19	-20	-30	-36	28	17	14	18	19	9	3	16	17	12	15
5,000	-16	-10	-8	-11	-11	-20	-25	15	10	8	10	11	2	-3	15	15	10	13
BUFFALO TO ELMIRA																		
15,000	33	24	18	19	23	10	3	-35	-25	-19	-21	-24	-38	-46	22	22	14	21
10,000	25	18	14	16	18	7	2	-26	-19	-15	-17	-19	-30	-36	17	18	12	16
5,000	14	10	9	9	10	1	-4	-14	-11	-9	-9	-11	-20	-25	15	15	11	13
BUFFALO TO NEW YORK																		
15,000	32	24	17	18	22	10	3	-34	-26	-18	-20	-23	-37	-44	21	21	13	20
10,000	25	19	14	15	18	8	2	-26	-19	-15	-16	-19	-29	-35	17	17	12	15
5,000	13	11	8	8	10	1	-3	-14	-11	-9	-9	-10	-19	-24	14	15	10	12
BUFFALO TO PHILADELPHIA																		
15,000	23	20	13	12	16	4	-2	-27	-22	-14	-14	-18	-32	-39	21	21	13	20
10,000	19	15	11	11	14	4	-1	-20	-16	-12	-13	-15	-26	-31	17	17	12	15
5,000	10	9	7	6	8	-1	-5	-11	-10	-7	-7	-8	-17	-22	14	15	10	12
BUFFALO TO PITTSBURGH																		
15,000	-20	-8	-8	-14	-12	-25	-32	15	6	6	12	9	-3	-10	21	21	13	20
10,000	-13	-6	-4	-9	-8	-18	-24	11	4	3	8	6	-4	-9	17	17	12	15
5,000	-7	-3	-2	-5	-4	-13	-18	6	2	2	5	4	-5	-10	15	15	10	13
BUFFALO TO ROCHESTER, N.Y.																		
15,000	38	23	19	24	25	12	5	-39	-25	-20	-25	-26	-41	-48	22	22	14	21
10,000	28	17	14	19	19	8	2	-28	-18	-15	-19	-20	-31	-37	17	18	12	16
5,000	15	10	9	10	11	2	-3	-16	-10	-9	-11	-11	-21	-26	15	16	11	13
BUFFALO TO SCRANTON																		
15,000	31	23	17	18	22	9	2	-34	-25	-18	-20	-23	-37	-45	22	21	13	20
10,000	24	18	14	15	17	7	2	-25	-19	-14	-16	-18	-29	-35	17	17	12	15
5,000	13	10	8	8	10	1	-4	-14	-11	-9	-9	-10	-19	-24	15	15	10	13
BUFFALO TO SYRACUSE																		
15,000	39	25	20	24	26	13	6	-40	-26	-21	-25	-27	-41	-49	22	22	14	21
10,000	28	18	15	19	20	9	3	-29	-19	-16	-20	-20	-31	-38	17	18	12	16
5,000	15	10	9	11	11	2	-3	-16	-11	-10	-11	-12	-21	-26	15	15	11	13
BUFFALO TO TORONTO																		
15,000	-27	-20	-16	-16	-19	-33	-40	24	19	15	14	17	4	-3	22	22	14	21
10,000	-20	-15	-12	-13	-15	-26	-32	18	14	12	12	14	3	-2	17	18	12	16
5,000	-11	-9	-7	-6	-8	-17	-23	10	8	7	6	8	-1	-6	15	16	11	13
BUFFALO TO WASHINGTON, D.C.																		
15,000	9	11	6	3	7	-5	-12	-13	-13	-7	-5	-9	-22	-29	21	21	13	19
10,000	8	8	6	5	7	-3	-9	-10	-10	-7	-6	-8	-18	-24	16	17	11	15
5,000	4	5	4	2	4	-5	-9	-5	-6	-4	-3	-4	-13	-18	14	14	10	12
BURBANK TO LOS ANGELES																		
15,000	2	0	-5	-2	-2	-13	-18	-4	-1	5	1	1	-10	-17	21	18	11	16
10,000	3	3	-4	-1	0	-9	-13	-4	-4	4	1	0	-9	-14	15	14	9	12
5,000	3	4	-1	4	2	-4	-7	-3	-4	1	-4	-2	-9	-12	10	9	7	9
BURBANK TO SAN FRANCISCO																		
15,000	-19	-15	-5	-7	-10	-22	-29	18	14	4	6	9	-1	-7	21	18	11	16
10,000	-12	-11	-1 ⁰	-5	-6	-16	-21	12	10	1	4	6	-2	-7	15	14	9	12
5,000	-5	-5	-4	-3	-4	-10	-14	5	5	3	3	4	-2	-5	11	9	7	9
284 N.MI.																		

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
BURLINGTON TO MONTPELIER																		
15,000	27	21	19	19	21	8	0	-30	-22	-20	-21	-23	-37	-44	23	22	15	21
10,000	23	16	15	16	17	6	1	-24	-17	-15	-17	-18	-29	-35	18	18	13	16
5,000	13	9	10	9	10	1	-4	-14	-10	-10	-10	-11	-20	-26	16	16	12	13
BUTTE TO GREAT FALLS																		
15,000	3	5	9	5	6	-6	-12	-5	-6	-10	-6	-7	-18	-24	18	17	13	17
10,000	3	3	5	4	4	-4	-9	-4	-4	-5	-5	-4	-12	-17	13	12	10	12
5,000	11	3	2	5	5	-2	-6	-11	-4	-2	-5	-5	-13	-17	12	11	9	11
BUTTE TO HELENA																		
15,000	4	5	10	6	6	-5	-11	-6	-6	-10	-7	-8	-19	-25	19	18	14	17
10,000	4	4	5	4	4	-4	-8	-5	-4	-5	-5	-5	-13	-17	13	12	10	12
5,000	11	3	2	5	5	-2	-6	-12	-4	-2	-5	-5	-13	-17	12	11	9	11
BUTTE TO IDAHO FALLS																		
15,000	10	3	-1	4	4	-8	-13	-12	-5	0	-6	-5	-17	-23	19	18	13	17
10,000	7	2	-1	3	3	-5	-9	-8	-3	0	-4	-3	-11	-16	13	12	10	12
5,000	-7	0	0	-2	-2	-9	-13	6	0	-1	2	2	-5	-8	11	10	8	10
CALGARY TO CRANBROOK																		
15,000	-10	-9	-10	-9	-9	-21	-27	8	7	9	8	8	-3	-9	19	17	14	17
10,000	-9	-6	-5	-7	-7	-15	-20	7	6	5	6	6	-2	-7	14	12	11	12
5,000	-11	-6	-3	-7	-7	-15	-19	11	5	3	7	6	-2	-6	13	11	10	12
CALGARY TO EDMONTON																		
15,000	-6	0	1	-3	-2	-13	-19	4	-1	-2	1	1	-10	-16	18	16	14	16
10,000	-4	-1	-1	-2	-2	-10	-15	3	0	0	1	1	-7	-11	14	12	11	12
5,000	4	3	1	2	3	-6	-10	-5	-3	-1	-3	-3	-11	-16	14	12	11	13
CALGARY TO GREAT FALLS																		
15,000	17	8	6	12	10	0	-6	-19	-9	-7	-14	-12	-23	-29	18	16	13	16
10,000	12	7	5	10	8	0	-4	-13	-7	-5	-10	-9	-17	-22	13	12	10	12
5,000	1	0	1	2	1	-7	-11	-2	0	-1	-2	-1	-9	-13	13	11	10	12
CALGARY TO LETHBRIDGE																		
15,000	17	8	6	13	11	0	-6	-19	-9	-7	-14	-12	-24	-30	18	17	14	17
10,000	13	7	6	10	9	0	-4	-14	-8	-6	-11	-9	-18	-23	14	12	11	12
5,000	2	0	1	2	1	-7	-11	-3	0	-1	-3	-2	-10	-14	13	12	10	12
CALGARY TO REGINA																		
15,000	25	16	17	20	19	9	3	-26	-16	-17	-21	-20	-30	-36	16	15	13	15
10,000	19	11	11	16	14	6	2	-20	-11	-11	-16	-15	-23	-27	13	11	10	11
5,000	13	4	4	9	7	-1	-5	-13	-4	-4	-10	-8	-16	-21	13	11	11	12
CALGARY TO SASKATOON																		
15,000	21	14	15	17	17	6	1	-22	-15	-16	-18	-17	-28	-33	17	15	13	15
10,000	16	10	9	14	12	4	0	-17	-10	-10	-14	-12	-21	-25	13	11	10	12
5,000	13	4	4	9	7	-1	-5	-13	-5	-4	-10	-8	-16	-21	13	12	11	12
CALGARY TO VANCOUVER																		
15,000	-22	-16	-14	-19	-17	-29	-35	21	15	13	19	17	6	0	18	17	14	17
10,000	-17	-13	-8	-14	-13	-21	-26	17	12	8	14	12	4	0	14	12	10	12
5,000	-12	-6	-4	-8	-7	-15	-19	12	6	4	8	7	0	-4	12	11	9	11
CARLSBAD TO EL PASO																		
15,000	-26	-22	-6	-10	-15	-27	-34	25	21	5	10	14	3	-2	18	16	10	15
10,000	-17	-13	-5	-7	-10	-18	-23	16	13	4	7	9	1	-3	14	12	9	11
5,000	-5	-4	-3	0	-3	-9	-13	5	4	3	0	3	-4	-7	11	11	7	10
CARLSHAD TO HOBBS																		
15,000	27	22	6	11	15	4	-2	-28	-23	-6	-11	-15	-28	-36	19	17	11	16
10,000	18	14	5	7	10	2	-3	-18	-14	-5	-7	-10	-20	-24	14	12	10	12
5,000	6	5	3	1	4	-3	-7	-6	-5	-4	-2	-4	-11	-15	12	12	8	11
CASPER TO CHEYENNE																		
15,000	18	11	7	13	11	1	-5	-20	-12	-7	-14	-13	-25	-31	19	18	12	17
10,000	13	8	4	9	8	0	-5	-13	-8	-4	-10	-9	-17	-22	13	12	10	12
5,000	-2	0	-2	-1	-1	-8	-12	2	0	2	0	1	-6	-9	10	11	9	10

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	DIRECT								RETURN											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
CASPER TO DENVER																			202 N.MI.	
15,000	13	7	3	9	7	-4	-9	-14	-8	-3	-10	-8	-20	-26	19	17	12	17		
10,000	9	5	1	6	5	-3	-7	-10	-6	-2	-7	-6	-14	-18	13	12	10	12		
5,000	-5	-3	-4	-4	-4	-10	-14	5	3	4	3	4	-3	-6	10	10	8	10		
CASPER TO RAPID CITY																			164 N.MI.	
15,000	20	14	16	17	17	6	0	-22	-15	-17	-18	-18	-29	-35	19	18	13	17		
10,000	14	9	10	11	11	3	-2	-15	-9	-10	-12	-11	-20	-24	13	13	11	13		
5,000	11	6	5	7	7	0	-4	-12	-6	-6	-8	-8	-15	-20	11	12	10	11		
CASPER TO SALT LAKE CITY																			277 N.MI.	
15,000	-19	-14	-15	-14	-15	-26	-32	17	14	15	13	15	4	-1	18	16	12	16		
10,000	-12	-9	-9	-10	-10	-17	-21	11	8	9	9	9	2	-2	12	11	9	11		
5,000	-4	-4	-4	-4	-4	-9	-12	4	4	3	4	4	-2	-4	9	8	7	8		
CASPER TO SHERIDAN																			114 N.MI.	
15,000	-13	-7	-1	-8	-7	-18	-25	11	6	0	7	5	-6	-12	19	18	13	17		
10,000	-10	-5	-1	-6	-5	-13	-18	9	4	0	5	4	-4	-8	13	12	10	12		
5,000	4	0	2	1	2	-5	-9	-4	0	-2	-2	-2	-9	-13	11	11	9	11		
CASTLE GARDEN TO CRANBROOK																			74 N.MI.	
15,000	22	15	15	19	18	6	0	-23	-16	-15	-20	-18	-30	-37	19	18	14	18		
10,000	18	12	9	14	13	4	-1	-18	-13	-9	-14	-13	-22	-27	15	13	11	13		
5,000	12	5	4	7	7	-1	-5	-12	-6	-4	-8	-7	-15	-20	13	11	10	12		
CASTLE GARDEN TO PENTICTON																			77 N.MI.	
15,000	-25	-16	-14	-21	-18	-31	-38	24	15	13	20	18	6	-1	20	19	14	18		
10,000	-19	-13	-8	-14	-13	-22	-28	18	12	8	14	13	4	-1	16	13	11	13		
5,000	-10	-4	-4	-6	-6	-13	-18	9	4	4	5	5	-2	-6	13	11	9	12		
CEDAR RAPIDS TO CHICAGO																			170 N.MI.	
15,000	35	23	18	21	24	11	5	-36	-24	-19	-22	-24	-38	-45	20	20	13	20		
10,000	26	18	14	16	18	8	3	-27	-18	-14	-17	-19	-29	-35	15	16	13	15		
5,000	14	8	7	10	10	1	-4	-14	-9	-8	-11	-10	-19	-25	15	15	11	13		
CEDAR RAPIDS TO DES MOINES																			90 N.MI.	
15,000	-33	-22	-18	-21	-23	-36	-43	32	21	17	20	22	9	3	20	20	13	20		
10,000	-24	-16	-13	-15	-17	-27	-33	23	16	13	15	16	6	1	15	16	12	15		
5,000	-12	-8	-7	-10	-9	-18	-23	12	8	7	9	9	0	-5	14	15	11	13		
CEDAR RAPIDS TO MINNEAPOLIS																			192 N.MI.	
15,000	-17	-11	-9	-12	-12	-24	-31	14	9	8	11	10	-2	-8	20	20	13	19		
10,000	-13	-9	-7	-9	-9	-19	-24	11	8	6	8	8	-2	-7	15	16	12	15		
5,000	-7	-5	-2	-5	-5	-14	-19	7	5	2	4	4	-5	-10	14	15	11	13		
CEDAR RAPIDS TO MOLINE																			59 N.MI.	
15,000	32	21	16	21	22	9	3	-33	-22	-17	-22	-23	-36	-44	21	21	13	20		
10,000	24	16	12	15	17	6	1	-25	-17	-13	-15	-17	-28	-33	15	17	13	15		
5,000	13	8	6	9	9	0	-5	-13	-9	-6	-10	-9	-19	-24	15	15	11	14		
CHARLESTON, S.C. TO CHARLOTTE																			146 N.MI.	
15,000	-8	-10	-2	-3	-5	-16	-23	4	8	1	2	3	-7	-13	19	19	11	18		
10,000	-8	-7	-2	-2	-4	-14	-19	6	5	1	1	3	-6	-11	15	15	10	14		
5,000	-3	-3	-2	-1	-2	-10	-14	2	2	2	1	2	-6	-10	13	12	9	12		
CHARLESTON, S.C. TO COLUMBIA																			83 N.MI.	
15,000	-21	-19	-4	-9	-12	-25	-32	18	17	4	8	11	0	-6	19	19	11	17		
10,000	-16	-13	-4	-6	-9	-19	-24	15	12	3	5	8	-1	-6	15	15	10	14		
5,000	-6	-6	-3	-3	-4	-12	-17	6	5	3	2	4	-4	-8	13	12	9	12		
CHARLESTON, S.C. TO FLORENCE																			79 N.MI.	
15,000	10	4	3	5	5	-5	-11	-13	-7	-3	-7	-7	-18	-25	19	19	11	18		
10,000	5	3	3	4	4	-5	-10	-7	-5	-3	-5	-5	-14	-19	15	15	10	14		
5,000	5	3	1	1	2	-5	-9	-5	-3	-2	-2	-3	-11	-15	13	12	9	12		
CHARLESTON, S.C. TO JACKSONVILLE																			170 N.MI.	
15,000	-18	-13	-5	-9	-10	-21	-28	16	12	5	8	9	0	-6	17	17	10	16		
10,000	-13	-9	-5	-6	-8	-17	-22	12	8	5	6	7	-1	-6	14	14	9	13		
5,000	-9	-6	-4	-3	-5	-13	-17	8	6	4	3	5	-2	-6	12	12	8	11		

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
CHARLESTON, S.C. TO NORFOLK																		
15,000	25	17	7	13	14	3	-2	-27	-19	-7	-14	-16	-28	-36	18	18	10	17
10,000	16	13	6	9	11	2	-3	-18	-14	-7	-10	-11	-21	-26	15	15	10	14
5,000	9	7	4	4	6	-2	-6	-10	-8	-4	-4	-6	-14	-19	13	12	9	12
CHARLESTON, S.C. TO SAVANNAH																		
15,000	-27	-20	-6	-13	-15	-28	-36	25	19	6	12	14	3	-2	18	18	10	17
10,000	-19	-14	-6	-9	-11	-21	-26	18	13	6	8	11	2	-3	15	15	10	14
5,000	-11	-8	-5	-4	-7	-15	-19	10	8	4	4	6	-1	-5	13	12	9	12
CHARLESTON, S.C. TO WILMINGTON, N.C.																		
15,000	29	22	8	14	16	5	0	-31	-23	-8	-15	-18	-31	-39	18	18	10	17
10,000	20	16	7	10	12	3	-2	-21	-16	-7	-10	-13	-23	-29	15	15	10	14
5,000	11	9	5	4	7	-1	-5	-12	-9	-5	-4	-7	-15	-20	13	12	9	12
CHARLESTON, W.VA. TO CHARLOTTE																		
15,000	0	5	2	0	2	-10	-16	-4	-8	-2	-1	-4	-15	-22	20	20	11	19
10,000	3	4	2	1	2	-7	-12	-6	-5	-3	-2	-4	-13	-18	15	16	11	14
5,000	2	2	2	1	2	-6	-11	-3	-3	-2	-1	-2	-10	-15	14	13	9	12
CHARLESTON, W.VA. TO CINCINNATI																		
15,000	-40	-28	-15	-22	-24	-39	-48	38	27	15	20	24	11	5	20	21	12	20
10,000	-29	-21	-13	-17	-19	-30	-36	28	20	12	16	19	8	3	16	17	11	15
5,000	-15	-11	-7	-9	-10	-19	-24	15	11	7	8	10	1	-3	14	14	10	12
CHARLESTON, W.VA. TO CLEVELAND																		
15,000	-5	-7	-2	0	-3	-15	-22	0	4	1	-2	1	-11	-18	21	21	12	20
10,000	-3	-5	-3	-2	-3	-13	-19	1	4	3	0	2	-8	-14	16	17	12	15
5,000	-2	-3	-2	-1	-2	-10	-15	0	2	1	0	1	-7	-12	14	14	10	12
CHARLESTON, W.VA. TO COLUMBUS, OHIO																		
15,000	-23	-18	-9	-11	-14	-28	-35	19	16	8	9	12	0	-6	21	21	12	20
10,000	-16	-14	-9	-10	-12	-22	-28	14	12	8	9	11	1	-5	16	17	12	15
5,000	-8	-7	-5	-5	-6	-15	-20	8	7	4	5	6	-3	-7	15	14	10	13
CHARLESTON, W.VA. TO GREENSBORO																		
15,000	15	15	6	7	10	-1	-8	-19	-18	-7	-8	-12	-25	-32	20	20	12	19
10,000	13	11	6	6	9	-1	-6	-15	-13	-7	-7	-10	-20	-26	16	16	11	15
5,000	7	6	4	3	5	-3	-7	-8	-7	-4	-4	-6	-14	-18	14	13	9	12
CHARLESTON, W.VA. TO HUNTINGTON																		
15,000	-42	-29	-15	-23	-25	-40	-49	41	28	15	22	25	12	5	21	21	12	20
10,000	-30	-21	-13	-17	-20	-31	-37	29	21	12	17	19	9	3	16	17	12	15
5,000	-16	-12	-7	-9	-10	-19	-24	15	11	7	8	10	1	-3	15	14	10	13
CHARLESTON, W.VA. TO HUNTSVILLE																		
15,000	-33	-21	-9	-16	-18	-32	-40	31	19	8	15	17	5	0	19	19	11	18
10,000	-22	-15	-8	-12	-14	-24	-29	21	14	7	11	13	3	-1	14	15	10	14
5,000	-12	-9	-5	-5	-7	-15	-20	11	8	5	5	7	-1	-5	14	13	9	12
CHARLESTON, W.VA. TO KNOXVILLE																		
15,000	-28	-17	-8	-15	-16	-29	-37	25	15	7	13	14	2	-4	20	20	11	19
10,000	-19	-12	-7	-10	-11	-22	-27	17	11	6	10	10	1	-4	15	16	11	15
5,000	-10	-7	-4	-4	-6	-14	-19	9	6	3	4	5	-3	-7	14	13	9	12
CHARLESTON, W.VA. TO LEXINGTON																		
15,000	-41	-28	-15	-22	-25	-40	-48	40	27	14	21	24	11	5	20	20	12	19
10,000	-29	-21	-12	-17	-19	-30	-36	29	20	12	16	19	8	3	16	16	11	15
5,000	-15	-11	-7	-8	-10	-19	-24	15	11	7	8	10	1	-3	14	14	10	12
CHARLESTON, W.VA. TO LOUISVILLE																		
15,000	-41	-28	-15	-22	-25	-40	-48	40	27	15	21	24	12	5	20	20	12	19
10,000	-29	-21	-12	-17	-19	-30	-36	29	20	12	16	19	9	3	15	16	11	15
5,000	-16	-11	-7	-8	-10	-19	-24	15	11	7	8	10	2	-3	14	14	9	12
CHARLESTON, W.VA. TO NEW YORK																		
15,000	40	26	16	23	25	13	7	-41	-27	-17	-24	-26	-40	-48	20	20	12	19
10,000	28	20	13	18	19	9	4	-29	-20	-13	-18	-20	-30	-36	16	16	11	14
5,000	15	10	7	9	10	2	-2	-15	-11	-7	-9	-10	-19	-23	14	13	9	12

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MINUS SIGNS DENOTE HEADWINDS.THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	D I R E C T								R E T U R N								JAN	APR	JUL	OCT		
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
CHARLESTON, W.VA. TO PITTSBURGH																			142 N.MI.			
15,000	18	8	7	13	11	-1	-8	-22	-11	-8	-15	-13	-26	-33	21	21	12	20				
10,000	13	6	4	8	7	-2	-8	-15	-8	-5	-9	-9	-19	-25	16	17	12	15				
5,000	7	3	2	4	4	-4	-9	-8	-4	-3	-5	-4	-13	-18	14	14	10	12				
CHARLESTON, W.VA. TO ROANOKE																			100 N.MI.			
15,000	28	23	11	14	18	6	0	-31	-25	-11	-15	-19	-33	-42	21	21	12	20				
10,000	22	17	10	12	15	5	0	-23	-18	-10	-13	-16	-26	-32	16	17	11	15				
5,000	12	9	6	6	8	0	-5	-12	-10	-6	-6	-8	-17	-22	14	14	9	13				
CHARLESTON, W.VA. TO WASHINGTON, D.C.																			216 N.MI.			
15,000	41	28	16	22	25	13	6	-42	-29	-16	-23	-26	-41	-50	20	20	12	19				
10,000	29	21	13	18	19	9	4	-30	-22	-13	-18	-20	-31	-37	16	17	11	15				
5,000	15	11	7	8	10	2	-2	-16	-12	-7	-9	-10	-19	-24	14	14	9	12				
CHARLOTTE TO CHATTANOOGA																			210 N.MI.			
15,000	-38	-29	-10	-18	-22	-37	-46	37	29	9	17	21	9	3	19	19	11	18				
10,000	-28	-21	-9	-13	-17	-28	-34	27	20	8	13	16	6	1	15	15	10	14				
5,000	-15	-11	-6	-5	-9	-17	-22	14	11	6	5	9	1	-4	14	13	9	12				
CHARLOTTE TO CLEVELAND																			374 N.MI.			
15,000	-5	-7	-2	-1	-3	-15	-21	0	5	1	-1	1	-10	-16	19	19	11	18				
10,000	-4	-5	-3	-2	-4	-13	-18	2	4	2	1	2	-7	-12	15	16	11	14				
5,000	-2	-3	-2	-1	-2	-10	-14	1	2	2	1	1	-6	-11	13	13	9	12				
CHARLOTTE TO COLUMBIA																			77 N.MI.			
15,000	-12	-5	-2	-5	-5	-17	-24	8	2	1	4	3	-7	-13	19	19	11	18				
10,000	-5	-3	-2	-4	-3	-13	-18	3	2	1	3	2	-7	-12	15	16	10	14				
5,000	-3	-2	0	-1	-2	-9	-14	2	1	0	1	1	-7	-11	14	13	9	12				
CHARLOTTE TO COLUMBUS, OHIO																			302 N.MI.			
15,000	-11	-12	-5	-5	-8	-19	-26	7	9	4	3	6	-5	-12	19	19	11	18				
10,000	-10	-9	-5	-4	-7	-16	-21	7	7	4	3	5	-4	-9	15	16	11	14				
5,000	-5	-4	-3	-3	-4	-12	-16	4	4	3	2	3	-5	-9	14	13	9	12				
CHARLOTTE TO DANVILLE																			112 N.MI.			
15,000	30	19	8	15	16	4	-2	-32	-21	-8	-16	-18	-32	-40	20	20	11	19				
10,000	19	14	7	11	12	2	-3	-21	-15	-7	-12	-13	-23	-29	15	16	11	15				
5,000	10	7	3	4	6	-2	-6	-11	-8	-4	-4	-6	-15	-19	14	13	9	12				
CHARLOTTE TO GREENSBORO																			71 N.MI.			
15,000	29	18	7	14	16	4	-2	-31	-20	-8	-15	-17	-31	-40	20	20	11	19				
10,000	18	13	6	10	11	2	-3	-20	-14	-7	-11	-12	-23	-28	16	16	11	15				
5,000	10	7	3	4	6	-2	-7	-11	-8	-4	-4	-6	-15	-19	14	13	9	13				
CHARLOTTE TO GREENVILLE																			73 N.MI.			
15,000	-38	-29	-9	-18	-22	-37	-46	37	28	9	17	21	8	2	20	20	11	19				
10,000	-27	-20	-9	-13	-16	-28	-34	27	19	8	13	16	6	1	15	16	10	15				
5,000	-15	-11	-6	-5	-9	-17	-22	14	10	5	5	8	0	-4	14	13	9	13				
CHARLOTTE TO JACKSONVILLE																			290 N.MI.			
15,000	-9	-4	-3	-5	-5	-15	-21	6	2	2	4	3	-6	-12	17	17	10	16				
10,000	-6	-3	-3	-4	-4	-12	-17	4	2	3	3	3	-5	-10	14	14	9	13				
5,000	-5	-3	-2	-2	-3	-10	-14	4	2	2	1	2	-5	-9	12	12	8	11				
CHARLOTTE TO PHILADELPHIA																			389 N.MI.			
15,000	30	18	10	17	17	6	0	-32	-20	-11	-18	-19	-32	-40	19	19	11	18				
10,000	20	14	8	12	13	4	-1	-21	-15	-8	-13	-14	-24	-29	15	16	10	14				
5,000	10	7	4	5	7	-1	-5	-11	-8	-5	-6	-7	-15	-20	13	13	9	12				
CHARLOTTE TO RALEIGH																			112 N.MI.			
15,000	37	27	10	18	21	9	3	-38	-28	-10	-19	-22	-37	-46	20	20	11	19				
10,000	26	19	9	13	16	6	1	-27	-20	-9	-14	-17	-28	-34	15	16	11	15				
5,000	14	10	5	5	8	0	-4	-14	-11	-5	-5	-8	-17	-22	14	13	9	12				
CHARLOTTE TO RICHMOND																			222 N.MI.			
15,000	33	22	10	17	19	7	1	-35	-24	-10	-18	-20	-34	-42	19	19	11	18				
10,000	22	16	8	12	14	4	-1	-23	-17	-8	-13	-15	-25	-31	15	16	10	14				
5,000	12	9	5	5	7	-1	-5	-12	-9	-5	-5	-7	-16	-21	14	13	9	12				

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
CHARLOTTE TO SPARTANBURG																		
15,000	-38	-28	-9	-18	-21	-37	-46	37	27	9	17	21	8	2	20	20	53 N.M.I.	19
10,000	-27	-20	-8	-13	-16	-27	-34	26	19	8	12	16	5	0	15	16	11	15
5,000	-14	-11	-5	-5	-8	-17	-22	14	10	5	5	8	0	-5	14	13	9	13
CHARLOTTE TO WASHINGTON, D.C.																		
15,000	28	17	9	16	16	5	-1	-31	-19	-9	-17	-17	-31	-39	19	19	287 N.M.I.	18
10,000	18	13	7	11	12	2	-3	-20	-14	-7	-12	-13	-23	-28	15	16	10	14
5,000	10	7	4	4	6	-2	-6	-10	-7	-4	-5	-6	-14	-19	14	13	9	12
CHATTANOOGA TO CINCINNATI																		
15,000	6	1	1	2	2	-9	-15	-10	-3	-2	-4	-4	-16	-23	19	19	242 N.M.I.	19
10,000	3	1	1	2	2	-8	-13	-6	-2	-1	-3	-3	-12	-17	15	16	11	14
5,000	2	1	1	1	1	-7	-12	-3	-2	-1	-1	-1	-10	-14	14	14	9	12
CHATTANOOGA TO GREENVILLE																		
15,000	36	28	9	17	21	8	2	-37	-29	-9	-18	-21	-37	-45	19	19	141 N.M.I.	18
10,000	27	20	8	12	16	6	1	-28	-20	-8	-13	-16	-27	-34	15	16	10	14
5,000	14	11	6	5	8	0	-4	-15	-11	-6	-5	-9	-17	-22	14	13	9	12
CHATTANOOGA TO KNOXVILLE																		
15,000	33	21	8	15	17	5	-1	-34	-23	-8	-16	-18	-33	-42	20	20	76 N.M.I.	19
10,000	22	15	7	11	13	3	-2	-23	-16	-7	-11	-14	-25	-30	15	16	11	15
5,000	12	9	5	4	7	-1	-6	-12	-9	-5	-4	-7	-16	-21	14	14	9	13
CHATTANOOGA TO LEXINGTON																		
15,000	9	2	2	3	4	-7	-14	-13	-5	-2	-5	-6	-18	-24	20	20	182 N.M.I.	19
10,000	5	2	2	3	3	-6	-12	-7	-3	-2	-4	-4	-13	-18	15	16	11	14
5,000	3	2	1	1	1	-7	-11	-4	-2	-1	-1	-2	-10	-15	14	14	9	12
CHATTANOOGA TO MEMPHIS																		
15,000	-38	-28	-9	-18	-21	-37	-45	37	27	8	17	20	8	2	19	19	235 N.M.I.	18
10,000	-27	-20	-8	-13	-16	-27	-33	27	19	7	12	15	6	1	14	15	10	14
5,000	-14	-11	-6	-5	-9	-17	-22	14	11	6	5	8	0	-4	14	14	9	12
CHATTANOOGA TO NASHVILLE																		
15,000	-25	-22	-7	-13	-16	-29	-37	23	20	7	12	14	3	-3	20	20	98 N.M.I.	19
10,000	-19	-15	-6	-9	-12	-22	-28	18	14	6	9	11	1	-3	15	16	11	15
5,000	-10	-8	-5	-4	-6	-15	-20	9	7	4	4	6	-2	-7	14	14	10	13
CHATTANOOGA TO ROME																		
15,000	-7	0	0	-1	-2	-13	-20	3	-2	-1	0	0	-11	-18	20	20	41 N.M.I.	19
10,000	-3	0	-1	-1	-1	-10	-15	0	-1	1	0	0	-9	-14	15	16	10	15
5,000	-2	-1	0	0	-1	-9	-14	1	0	0	0	0	-8	-13	14	14	9	13
CHEYENNE TO DENVER																		
15,000	3	-1	-3	2	-1	-11	-18	-5	-1	3	-3	-1	-13	-19	20	18	83 N.M.I.	17
10,000	2	1	-3	1	0	-8	-12	-3	-1	2	-2	-1	-9	-14	14	13	10	13
5,000	-6	-6	-6	-6	-6	-12	-16	6	5	6	6	6	-1	-4	10	11	8	10
CHICAGO TO CINCINNATI																		
15,000	24	17	11	15	16	4	-2	-27	-19	-12	-16	-18	-31	-38	20	20	230 N.M.I.	19
10,000	18	14	9	11	13	3	-2	-19	-15	-10	-12	-14	-24	-30	15	16	12	15
5,000	9	7	4	6	7	-2	-7	-10	-8	-5	-7	-7	-16	-21	14	15	10	13
CHICAGO TO CLEVELAND																		
15,000	38	25	19	23	25	13	6	-39	-26	-19	-24	-26	-40	-47	20	20	273 N.M.I.	19
10,000	28	19	15	18	19	9	4	-28	-20	-15	-18	-20	-30	-36	15	16	12	15
5,000	15	10	8	10	10	2	-3	-15	-10	-8	-10	-11	-20	-25	14	15	10	12
CHICAGO TO COLUMBUS, OHIO																		
15,000	34	23	16	20	23	10	4	-36	-25	-17	-21	-24	-37	-45	20	20	256 N.M.I.	19
10,000	25	18	13	16	18	8	2	-26	-19	-14	-16	-18	-29	-34	15	16	12	15
5,000	13	10	7	9	9	1	-4	-14	-10	-7	-9	-10	-19	-24	14	15	10	12
CHICAGO TO DAYTON																		
15,000	31	21	15	18	20	8	2	-33	-23	-15	-20	-22	-35	-43	20	20	209 N.M.I.	20
10,000	23	16	12	14	16	6	1	-24	-17	-12	-15	-17	-27	-33	15	17	12	15
5,000	12	9	6	8	8	0	-5	-13	-9	-6	-8	-9	-18	-23	15	15	10	13

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION				
	DIRECT								RETURN								JAN	APR	JUL	OCT	
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85							
CHICAGO TO OES MOINES																		259 N.MI.			
15,000	-35	-23	-18	-22	-24	-37	-44			34	22	18	21	23	11	5	20	20	13	19	
10,000	-26	-18	-14	-16	-18	-28	-34			25	17	13	16	18	8	2	15	16	12	15	
5,000	-14	-9	-7	-10	-10	-19	-24			13	8	7	10	9	1	-4	14	15	11	13	
CHICAGO TO DETROIT																		203 N.MI.			
15,000	37	24	19	22	25	12	6			-38	-25	-19	-23	-25	-39	-46	20	20	13	20	
10,000	27	18	14	17	19	9	3			-28	-19	-15	-18	-19	-30	-36	16	17	12	15	
5,000	15	9	8	10	10	1	-3			-15	-10	-8	-11	-11	-20	-25	15	15	10	13	
CHICAGO TO EVANSVILLE																		237 N.MI.			
15,000	0	2	1	2	1	-10	-17			-5	-4	-2	-4	-4	-16	-22	20	20	12	19	
10,000	1	2	1	1	1	-8	-14			-3	-3	-2	-2	-3	-12	-17	15	16	12	15	
5,000	1	1	0	0	0	-8	-13			-2	-2	0	-1	-1	-10	-14	14	15	10	13	
CHICAGO TO GRAND RAPIDS																		113 N.MI.			
15,000	30	19	16	18	20	8	1			-32	-20	-16	-20	-21	-35	-42	21	21	13	20	
10,000	22	14	12	14	15	5	0			-23	-15	-12	-15	-16	-27	-33	16	17	13	15	
5,000	12	7	7	9	8	-1	-5			-13	-7	-7	-10	-9	-18	-23	15	15	11	13	
CHICAGO TO INDIANAPOLIS																		154 N.MI.			
15,000	17	13	9	12	12	0	-6			-21	-15	-10	-13	-14	-27	-34	20	21	13	20	
10,000	13	10	7	8	9	-1	-6			-15	-11	-8	-9	-11	-21	-26	15	17	12	15	
5,000	7	5	3	4	5	-4	-9			-8	-6	-3	-5	-5	-14	-19	15	15	10	13	
CHICAGO TO KANSAS CITY																		350 N.MI.			
15,000	-31	-21	-15	-18	-20	-33	-40			30	20	15	16	19	8	2	19	19	12	19	
10,000	-23	-16	-11	-14	-16	-26	-31			22	15	11	13	15	5	0	14	15	12	14	
5,000	-12	-8	-7	-9	-9	-17	-22			11	8	7	8	8	0	-5	14	14	10	12	
CHICAGO TO LOUISVILLE																		249 N.MI.			
15,000	14	11	7	9	10	-2	-8			-17	-13	-8	-11	-12	-24	-31	20	20	12	19	
10,000	10	8	6	6	8	-2	-7			-12	-10	-6	-7	-9	-19	-24	15	16	12	15	
5,000	6	5	2	4	4	-5	-9			-7	-5	-3	-4	-4	-13	-18	14	14	10	13	
CHICAGO TO MADISON																		94 N.MI.			
15,000	-27	-18	-15	-18	-19	-32	-39			25	17	14	16	17	5	-2	21	21	14	20	
10,000	-20	-14	-11	-13	-14	-25	-30			18	13	11	12	13	3	-2	16	17	13	15	
5,000	-11	-8	-5	-7	-7	-17	-22			10	7	5	7	7	-2	-7	15	16	11	13	
CHICAGO TO MILWAUKEE																		58 N.MI.			
15,000	-4	-3	-2	-3	-3	-15	-23			0	1	1	1	1	-12	-19	21	21	14	20	
10,000	-2	-2	-2	-2	-2	-12	-18			0	1	1	0	1	-9	-15	16	17	13	15	
5,000	-1	-2	0	0	-1	-10	-15			0	2	-1	-1	0	-9	-14	15	16	11	14	
CHICAGO TO MINNEAPOLIS																		290 N.MI.			
15,000	-30	-20	-17	-20	-21	-34	-41			28	19	17	19	20	8	2	20	19	13	19	
10,000	-22	-15	-13	-15	-16	-26	-31			21	14	13	14	15	6	0	15	16	12	14	
5,000	-12	-8	-6	-9	-9	-18	-23			12	7	6	8	8	-1	-5	14	15	11	13	
CHICAGO TO MOLINE																		121 N.MI.			
15,000	-35	-23	-18	-21	-23	-37	-44			34	22	17	20	22	10	3	20	21	13	20	
10,000	-26	-18	-14	-16	-18	-29	-34			25	17	13	15	17	7	2	15	17	13	15	
5,000	-14	-9	-7	-10	-10	-19	-24			13	8	7	10	9	0	-4	15	15	11	13	
CHICAGO TO MUSKEGON																		103 N.MI.			
15,000	23	14	12	14	15	3	-4			-26	-16	-13	-15	-17	-30	-37	21	21	14	20	
10,000	17	11	9	11	12	2	-4			-19	-12	-10	-12	-13	-23	-29	16	17	13	15	
5,000	9	4	6	7	7	-2	-7			-10	-5	-6	-8	-7	-16	-21	15	15	11	13	
CHICAGO TO NASHVILLE																		356 N.MI.			
15,000	3	4	2	4	3	-8	-14			-7	-6	-3	-6	-5	-17	-23	19	19	12	19	
10,000	3	3	2	2	2	-7	-12			-5	-5	-2	-3	-4	-13	-18	14	15	11	14	
5,000	2	2	0	1	1	-7	-11			-3	-2	-1	-2	-2	-10	-14	14	14	9	12	
CHICAGO TO PITTSBURGH																		358 N.MI.			
15,000	38	25	18	22	25	13	7			-39	-26	-18	-23	-26	-39	-47	20	20	12	19	
10,000	28	19	14	18	19	9	4			-28	-20	-15	-18	-20	-30	-36	15	16	11	14	
5,000	15	10	8	10	10	2	-2			-15	-11	-8	-10	-11	-19	-24	14	14	10	12	

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HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION				
	O I R E C T								R E T U R N												
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT			
CHICAGO TO ROCHESTER, N.Y.																					
15,000	37	23	19	23	25	13	7	-39	-24	-20	-24	-26	-39	-46	20	19	12	19	457 N.MI.		
10,000	27	18	14	18	19	9	4	-28	-18	-15	-19	-19	-30	-35	15	16	11	14			
5,000	15	9	8	10	10	2	-2	-15	-10	-9	-11	-11	-19	-24	14	14	10	12			
CHICAGO TO ST. LOUIS																					
15,000	-20	-13	-9	-9	-12	-25	-32	17	11	8	7	10	-1	-8	20	20	13	19	224 N.MI.		
10,000	-15	-10	-7	-8	-10	-20	-25	13	9	6	7	8	-1	-6	15	16	12	15			
5,000	-8	-5	-5	-5	-5	-14	-19	7	4	4	5	5	-4	-8	15	15	10	13			
CHICAGO TO SAGINAW																					
15,000	30	19	16	19	20	8	1	-32	-20	-17	-20	-21	-35	-42	21	20	13	20	192 N.MI.		
10,000	22	14	12	15	15	5	0	-23	-15	-12	-15	-16	-27	-33	16	17	12	15			
5,000	12	7	7	9	9	0	-5	-13	-7	-7	-10	-9	-18	-23	15	15	11	13			
CHICAGO TO SOUTH BEND																					
15,000	36	24	18	22	24	11	5	-37	-25	-19	-23	-25	-39	-46	21	21	13	20	73 N.MI.		
10,000	27	18	14	17	19	8	3	-27	-19	-15	-17	-19	-30	-36	16	17	13	15			
5,000	14	9	7	10	10	1	-4	-15	-10	-8	-10	-10	-20	-25	15	15	11	13			
CHICAGO TO SPRINGFIELD, ILL.																					
15,000	-18	-11	-8	-8	-11	-23	-30	14	9	7	6	9	-3	-10	20	20	13	20	183 N.MI.		
10,000	-13	-9	-6	-8	-9	-19	-24	11	7	5	6	7	-2	-8	15	16	12	15			
5,000	-7	-4	-4	-5	-5	-14	-18	6	3	4	4	4	-4	-9	15	15	10	13			
CHICAGO TO TOLEDO																					
15,000	37	24	19	23	25	12	6	-39	-25	-19	-24	-26	-40	-47	20	20	13	20	185 N.MI.		
10,000	27	19	14	17	19	9	3	-28	-19	-15	-18	-20	-30	-36	16	17	12	15			
5,000	15	10	8	10	10	1	-3	-15	-10	-8	-10	-11	-20	-25	15	15	10	13			
CHICAGO TO TORONTO																					
15,000	35	22	18	22	23	11	5	-37	-23	-19	-23	-24	-38	-45	20	20	13	19	378 N.MI.		
10,000	26	16	14	17	18	8	3	-27	-17	-14	-18	-19	-29	-34	15	16	12	14			
5,000	14	8	8	10	10	2	-3	-15	-9	-8	-11	-10	-19	-24	14	14	10	12			
CHICAGO TO WATERLOO																					
15,000	-35	-24	-19	-23	-24	-38	-45	34	23	19	22	24	11	5	20	20	13	19	203 N.MI.		
10,000	-26	-18	-14	-17	-19	-29	-34	26	17	14	16	18	8	3	15	16	12	15			
5,000	-14	-9	-7	-10	-10	-19	-24	14	8	7	10	9	1	-4	14	15	11	13			
CINCINNATI TO CLEVELAND																					
15,000	26	15	12	16	16	4	-2	-30	-17	-12	-18	-18	-32	-39	21	21	12	20	192 N.MI.		
10,000	19	12	8	12	12	2	-3	-21	-13	-9	-13	-13	-24	-30	16	17	12	15			
5,000	10	6	5	7	7	-2	-6	-11	-7	-5	-7	-7	-16	-21	14	15	10	12			
CINCINNATI TO COLUMBUS, OHIO																					
15,000	33	20	14	19	20	8	1	-36	-22	-14	-20	-22	-36	-44	21	21	13	20	100 N.MI.		
10,000	24	16	10	14	16	5	0	-25	-17	-11	-15	-16	-27	-33	16	17	12	15			
5,000	12	8	6	8	8	0	-5	-13	-9	-6	-8	-9	-18	-23	15	15	10	13			
CINCINNATI TO DAYTON																					
15,000	14	7	6	8	8	-4	-10	-18	-9	-7	-10	-11	-24	-31	21	21	13	20	55 N.MI.		
10,000	10	5	4	6	6	-4	-9	-12	-7	-4	-7	-8	-18	-24	16	17	12	15			
5,000	5	3	2	3	3	-5	-10	-6	-4	-3	-4	-4	-13	-18	15	15	10	13			
CINCINNATI TO DETROIT																					
15,000	10	4	4	6	6	-6	-13	-14	-6	-5	-9	-8	-21	-28	20	21	13	20	200 N.MI.		
10,000	7	3	2	5	4	-6	-11	-10	-5	-3	-6	-6	-16	-21	16	17	12	15			
5,000	4	2	2	3	3	-6	-11	-5	-2	-2	-3	-3	-12	-16	14	15	10	13			
CINCINNATI TO INDIANAPOLIS																					
15,000	-36	-25	-15	-21	-23	-37	-45	34	24	14	19	22	9	3	21	21	13	20	85 N.MI.		
10,000	-26	-19	-12	-15	-18	-29	-34	25	18	12	15	17	7	1	16	17	12	15			
5,000	-14	-10	-6	-8	-9	-18	-24	13	10	6	8	9	0	-4	15	15	10	13			
CINCINNATI TO KNOXVILLE																					
15,000	1	5	2	1	2	-9	-16	-5	-7	-3	-3	-4	-16	-23	20	20	12	19	197 N.MI.		
10,000	2	4	2	1	2	-7	-12	-5	-5	-2	-2	-3	-13	-18	15	16	11	15			
5,000	1	2	1	1	1	-7	-11	-2	-2	-1	-1	-2	-10	-15	14	14	9	12			

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEAD WINDS*								STANDARD DEVIATION					
	O I R E C T								R E T U R N													
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
CINCINNATI TO LEXINGTON																			61 N.MI.			
15,000	-2	2	0	-1	0	-12	-19	-2	-5	-1	-1	-2	-14	-21	21	21	12	20				
10,000	0	2	1	0	0	-9	-15	-2	-3	-1	-1	-2	-12	-17	16	17	12	15				
5,000	0	1	0	0	0	-8	-13	-1	-1	-1	-1	-1	-9	-14	15	15	10	13				
CINCINNATI TO LOUISVILLE																			72 N.MI.			
15,000	-30	-19	-11	-16	-18	-32	-40	28	17	10	15	16	4	-2	21	21	12	20				
10,000	-21	-14	-8	-12	-13	-24	-30	20	13	8	11	13	2	-3	16	17	12	15				
5,000	-11	-8	-5	-6	-7	-16	-21	10	7	5	6	7	-2	-7	15	15	10	13				
CINCINNATI TO NASHVILLE																			200 N.MI.			
15,000	-23	-13	-7	-11	-13	-25	-33	20	11	6	9	11	-1	-7	20	20	12	19				
10,000	-16	-10	-6	-8	-9	-19	-25	14	8	5	7	8	-1	-6	15	16	11	15				
5,000	-8	-6	-4	-4	-5	-13	-18	7	5	3	3	5	-4	-8	14	14	10	12				
CINCINNATI TO PITTSBURGH																			222 N.MI.			
15,000	38	24	16	22	24	11	5	-40	-25	-16	-23	-25	-39	-47	20	21	12	19				
10,000	27	18	12	17	18	8	3	-28	-19	-13	-18	-19	-30	-35	16	17	12	15				
5,000	14	10	7	9	9	1	-3	-15	-10	-7	-9	-10	-19	-24	14	14	10	12				
CINCINNATI TO ST. LOUIS																			267 N.MI.			
15,000	-40	-27	-16	-22	-24	-39	-47	39	26	15	21	24	11	5	20	20	12	19				
10,000	-29	-20	-12	-16	-19	-30	-35	28	20	12	16	18	8	3	15	16	11	14				
5,000	-15	-11	-7	-9	-10	-19	-24	15	10	7	9	10	1	-3	14	14	10	12				
CINCINNATI TO WASHINGTON, O.C.																			356 N.MI.			
15,000	41	28	16	22	25	13	7	-42	-29	-17	-23	-26	-40	-49	20	20	12	19				
10,000	30	21	13	18	20	10	5	-30	-22	-14	-18	-20	-31	-37	15	16	11	14				
5,000	15	11	7	9	10	2	-2	-16	-12	-8	-9	-11	-19	-24	14	13	9	12				
CLEVELAND TO COLUMBUS, OHIO																			97 N.MI.			
15,000	-22	-11	-9	-14	-13	-27	-34	18	9	8	12	11	-1	-8	21	21	13	20				
10,000	-15	-8	-6	-10	-9	-20	-26	13	7	5	9	8	-2	-8	16	17	12	15				
5,000	-8	-4	-3	-5	-5	-14	-19	7	4	3	5	4	-4	-9	15	15	10	13				
CLEVELAND TO DAYTON																			141 N.MI.			
15,000	-33	-19	-14	-20	-20	-34	-42	30	17	13	18	19	6	0	21	21	13	20				
10,000	-23	-15	-10	-15	-15	-26	-32	22	13	10	14	14	4	-1	16	17	12	15				
5,000	-12	-8	-6	-8	-8	-17	-22	11	7	5	8	8	-1	-6	15	15	10	13				
CLEVELAND TO DETROIT																			83 N.MI.			
15,000	-34	-24	-17	-20	-22	-37	-44	32	22	16	18	21	8	2	21	21	13	20				
10,000	-24	-18	-14	-16	-17	-28	-34	23	17	13	15	17	6	1	17	17	12	15				
5,000	-13	-10	-7	-8	-9	-19	-24	12	9	7	8	9	0	-5	15	15	10	13				
CLEVELAND TO FT. WAYNE																			153 N.MI.			
15,000	-40	-26	-18	-24	-26	-40	-48	39	25	18	23	25	12	6	21	21	13	20				
10,000	-29	-20	-14	-18	-20	-31	-37	28	19	14	18	19	9	3	16	17	12	15				
5,000	-15	-10	-8	-10	-11	-20	-25	15	10	8	10	10	2	-3	15	15	10	13				
CLEVELAND TO GRAND RAPIDS																			192 N.MI.			
15,000	-36	-24	-18	-22	-24	-38	-45	34	23	18	20	23	10	4	21	21	13	20				
10,000	-26	-18	-14	-17	-18	-29	-35	25	18	14	16	18	8	2	16	17	12	15				
5,000	-14	-10	-8	-9	-10	-19	-24	13	10	7	9	10	1	-4	15	15	10	13				
CLEVELAND TO INDIANAPOLIS																			226 N.MI.			
15,000	-37	-23	-16	-22	-23	-38	-45	35	22	16	21	22	10	4	20	21	13	20				
10,000	-27	-18	-12	-17	-18	-29	-34	26	17	12	16	17	7	2	16	17	12	15				
5,000	-14	-9	-7	-9	-10	-18	-23	14	9	7	9	9	1	-4	14	15	10	12				
CLEVELAND TO KNOXVILLE																			351 N.MI.			
15,000	-16	-7	-5	-9	-9	-21	-27	11	4	4	7	6	-5	-11	19	19	11	19				
10,000	-10	-5	-3	-6	-6	-15	-21	8	3	2	5	4	-5	-10	15	16	11	14				
5,000	-5	-3	-2	-3	-3	-11	-15	4	2	1	2	2	-6	-10	14	13	9	12				
CLEVELAND TO MILWAUKEE																			284 N.MI.			
15,000	-37	-25	-19	-23	-25	-38	-46	36	24	18	22	24	12	5	20	20	13	19				
10,000	-27	-19	-15	-18	-19	-30	-35	26	18	14	17	19	9	3	15	16	12	15				
5,000	-15	-10	-8	-10	-10	-19	-24	14	10	8	10	10	1	-3	14	15	10	13				

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	D I R E C T								R E T U R N								JAN	APR	JUL	OCT		
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
CLEVELAND TO NEW YORK																			368 N.MI.			
15,000	41	28	19	23	26	14	8	-42	-29	-19	-24	-27	-41	-49	20	20	12	19				
10,000	30	21	15	19	21	11	5	-30	-22	-16	-19	-21	-32	-38	16	16	11	14				
5,000	16	12	9	10	11	3	-1	-16	-12	-9	-10	-12	-20	-25	14	14	10	12				
CLEVELAND TO PHILADELPHIA																			315 N.MI.			
15,000	40	28	18	22	25	13	7	-41	-29	-18	-23	-26	-41	-49	21	20	12	19				
10,000	29	21	15	18	20	10	5	-30	-22	-15	-19	-21	-31	-37	16	17	11	15				
5,000	15	12	8	9	11	3	-2	-16	-12	-9	-10	-11	-20	-25	14	14	10	12				
CLEVELAND TO PITTSBURGH																			93 N.MI.			
15,000	32	24	15	17	21	8	2	-35	-25	-16	-19	-22	-37	-45	22	21	13	20				
10,000	23	18	13	15	17	7	1	-25	-19	-13	-16	-18	-29	-35	17	17	12	15				
5,000	12	10	7	8	9	0	-4	-13	-10	-7	-8	-9	-18	-23	15	15	10	13				
CLEVELAND TO ROCHESTER, N.Y.																			212 N.MI.			
15,000	35	20	16	22	22	10	3	-37	-22	-17	-23	-23	-38	-45	21	21	13	20				
10,000	25	15	12	17	17	6	1	-26	-16	-12	-17	-17	-28	-34	16	17	12	15				
5,000	14	8	7	9	9	1	-4	-14	-9	-7	-10	-10	-19	-24	15	15	10	12				
CLEVELAND TO TOLEDO																			88 N.MI.			
15,000	-41	-27	-19	-24	-26	-41	-49	40	26	19	23	26	13	6	21	21	13	20				
10,000	-29	-20	-15	-19	-20	-31	-38	28	20	15	18	20	9	4	16	17	12	15				
5,000	-16	-11	-8	-10	-11	-20	-25	15	10	8	10	11	2	-3	15	15	10	13				
CLEVELAND TO TORONTO																			168 N.MI.			
15,000	21	10	10	15	13	1	-6	-25	-12	-11	-16	-15	-29	-36	21	21	13	20				
10,000	16	8	6	11	10	0	-6	-18	-9	-7	-12	-11	-22	-28	17	17	12	15				
5,000	9	4	4	7	6	-3	-8	-10	-5	-4	-7	-6	-15	-20	15	15	10	13				
CLEVELAND TO WASHINGTON, D.C.																			269 N.MI.			
15,000	33	25	15	17	21	9	3	-36	-26	-15	-18	-23	-37	-45	21	20	12	19				
10,000	24	19	13	15	17	7	2	-26	-20	-13	-16	-18	-29	-34	16	17	11	15				
5,000	13	10	7	8	9	1	-3	-13	-11	-7	-8	-10	-18	-23	14	14	10	12				
CLOVIS TO LUBBOCK																			77 N.MI.			
15,000	23	18	4	11	12	1	-4	-24	-19	-4	-12	-13	-26	-34	19	17	11	16				
10,000	15	10	2	6	8	-1	-5	-16	-11	-3	-7	-8	-18	-23	14	13	10	12				
5,000	2	0	-3	-1	-1	-8	-12	-2	-1	2	1	0	-7	-12	12	13	9	11				
CLOVIS TO SANTA FE																			164 N.MI.			
15,000	-26	-20	-7	-13	-15	-27	-35	24	20	6	12	14	3	-2	19	17	11	16				
10,000	-17	-12	-4	-8	-9	-18	-23	16	11	4	7	9	1	-3	14	12	10	12				
5,000	-2	-1	2	2	0	-6	-10	2	1	-2	-2	-1	-7	-11	11	11	8	10				
COLLEGE STATION TO HOUSTON																			80 N.MI.			
15,000	17	15	1	7	9	-1	-7	-19	-16	-1	-8	-10	-22	-28	17	16	10	16				
10,000	9	7	-1	4	4	-4	-8	-11	-8	1	-5	-5	-14	-19	14	13	10	12				
5,000	3	0	-4	0	-1	-8	-13	-3	0	3	-1	0	-8	-12	14	13	9	12				
COLLEGE STATION TO TEMPLE																			64 N.MI.			
15,000	-24	-20	-2	-10	-13	-25	-33	22	19	1	10	12	1	-5	18	16	11	16				
10,000	-15	-11	-1	-6	-7	-17	-22	14	10	0	6	7	-2	-6	14	13	10	13				
5,000	-6	-2	2	-1	-1	-10	-14	5	2	-2	1	1	-7	-11	14	13	9	12				
COLORADO SPRINGS TO DENVER																			58 N.MI.			
15,000	-8	-3	0	-5	-4	-15	-22	6	2	-1	4	2	-9	-15	20	18	12	17				
10,000	-5	-3	1	-3	-2	-11	-15	4	2	-1	3	2	-7	-11	14	13	10	13				
5,000	5	5	6	5	5	-1	-4	-5	-5	-6	-6	-6	-12	-16	10	11	8	10				
COLORADO SPRINGS TO OKLAHOMA CITY																			397 N.MI.			
15,000	25	19	9	15	16	5	0	-27	-20	-9	-16	-17	-29	-35	18	17	11	16				
10,000	17	12	5	10	11	2	-2	-18	-12	-6	-10	-11	-20	-25	13	13	10	12				
5,000	5	3	1	3	3	-4	-8	-5	-4	-1	-3	-3	-11	-15	12	12	9	11				
COLORADO SPRINGS TO PUEBLO																			33 N.MI.			
15,000	10	5	1	7	5	-6	-12	-12	-7	-2	-8	-7	-18	-25	20	18	12	17				
10,000	7	4	0	4	4	-5	-9	-8	-5	-1	-5	-4	-13	-18	14	13	10	13				
5,000	-4	-5	-6	-5	-5	-11	-15	4	4	6	5	5	-2	-6	10	11	8	10				

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	DIRECT							RETURN							JAN	APR	JUL	OCT				
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
COLUMBIA TO FLORENCE																			71 N.MI.			
15,000	36	28	9	16	20	8	2	-37	-29	-9	-17	-21	-36	-45	19	19	11	18				
10,000	26	19	8	12	15	5	0	-26	-20	-8	-12	-16	-27	-33	15	16	10	14				
5,000	13	10	5	5	8	0	-4	-14	-11	-6	-5	-8	-17	-22	14	13	9	12				
COLUMBIA TO GREENVILLE																			82 N.MI.			
15,000	-25	-22	-7	-12	-15	-28	-36	22	21	6	10	14	2	-4	19	19	11	18				
10,000	-20	-15	-6	-8	-11	-22	-28	19	15	5	7	11	1	-4	15	16	10	14				
5,000	-10	-8	-4	-4	-6	-14	-19	9	7	4	3	6	-2	-7	14	13	9	12				
COLUMBIA, S.C. TO JACKSONVILLE																			214 N.MI.			
15,000	-9	-4	-3	-4	-5	-15	-21	5	2	2	3	3	-6	-12	17	17	10	16				
10,000	-6	-3	-3	-4	-4	-12	-17	4	2	3	3	3	-5	-10	14	14	9	13				
5,000	-6	-3	-2	-2	-3	-11	-15	5	3	2	1	3	-5	-9	12	12	8	11				
COLUMBIA TO MERIDIAN																			395 N.MI.			
15,000	-35	-27	-7	-16	-19	-34	-41	34	26	7	15	19	7	2	17	17	10	16				
10,000	-25	-18	-7	-11	-14	-24	-30	24	18	6	10	14	5	0	13	14	9	13				
5,000	-13	-10	-5	-5	-8	-16	-20	13	10	5	4	8	0	-4	13	12	8	11				
COLUMBIA TO MONTGOMERY																			283 N.MI.			
15,000	-34	-26	-7	-15	-19	-33	-41	34	25	7	15	18	6	1	18	18	10	17				
10,000	-24	-18	-7	-10	-14	-24	-30	24	17	7	10	13	4	0	14	14	10	13				
5,000	-13	-10	-5	-5	-8	-16	-20	12	10	5	4	7	0	-4	13	12	9	12				
COLUMBIA TO PENSACOLA																			373 N.MI.			
15,000	-30	-22	-6	-13	-16	-29	-37	29	21	5	12	15	5	-1	17	17	10	16				
10,000	-21	-15	-6	-9	-12	-22	-27	20	15	6	8	11	3	-2	13	14	9	13				
5,000	-12	-9	-5	-4	-7	-15	-19	11	9	5	4	7	-1	-4	12	12	8	11				
COLUMBIA, S.C. TO RALEIGH																			162 N.MI.			
15,000	50	20	7	14	16	4	-1	-32	-22	-7	-15	-17	-32	-40	19	19	11	18				
10,000	19	14	6	10	12	2	-2	-20	-15	-7	-11	-13	-23	-29	15	16	10	14				
5,000	10	8	3	3	6	-2	-6	-11	-8	-4	-4	-6	-14	-19	14	12	9	12				
COLUMBIA TO SAVANNAH																			116 N.MI.			
15,000	-6	-1	-2	-3	-3	-13	-19	3	-1	2	2	1	-9	-15	18	18	10	17				
10,000	-3	-1	-2	-3	-2	-11	-16	1	0	2	2	1	-7	-12	15	15	10	14				
5,000	-4	-2	-1	-1	-2	-10	-14	3	1	1	1	1	-6	-10	13	12	9	12				
COLUMBIA TO WASHINGTON, D.C.																			354 N.MI.			
15,000	24	14	7	13	13	2	-3	-27	-17	-7	-15	-15	-28	-36	19	19	11	18				
10,000	15	11	5	9	10	1	-4	-17	-12	-6	-10	-11	-20	-26	15	15	10	14				
5,000	8	6	3	3	5	-3	-7	-9	-6	-3	-4	-5	-13	-18	13	12	9	12				
COLUMBUS, GA. TO MONTGOMERY																			75 N.MI.			
15,000	-34	-26	-6	-15	-19	-33	-41	33	25	6	14	18	6	0	18	18	10	17				
10,000	-24	-18	-6	-10	-13	-24	-30	23	17	5	9	13	3	-2	14	15	10	14				
5,000	-12	-10	-5	-5	-7	-16	-20	12	9	5	4	7	-1	-5	13	13	9	12				
COLUMBUS, GA. TO PENSACOLA																			168 N.MI.			
15,000	-26	-18	-4	-10	-13	-26	-33	24	17	3	10	12	1	-4	17	17	10	16				
10,000	-18	-13	-5	-6	-10	-19	-25	17	12	5	6	9	1	-4	14	14	10	13				
5,000	-11	-8	-5	-4	-6	-14	-19	10	8	4	3	6	-2	-6	13	12	9	12				
COLUMBUS, GA. TO TALLAHASSEE																			131 N.MI.			
15,000	3	5	1	1	2	-8	-13	-6	-7	-1	-2	-3	-14	-20	17	17	10	16				
10,000	1	2	-2	1	0	-8	-13	-3	-4	2	-1	-1	-10	-15	14	14	10	13				
5,000	-3	-1	-2	0	-1	-9	-13	2	1	1	0	1	-7	-11	13	12	9	12				
COLUMBUS, OHIO TO DAYTON																			62 N.MI.			
15,000	-42	-28	-18	-24	-26	-41	-50	41	26	17	23	26	13	6	21	21	13	20				
10,000	-30	-21	-14	-19	-20	-32	-38	29	20	14	18	20	9	4	16	17	12	15				
5,000	-16	-11	-8	-10	-11	-20	-25	15	11	7	10	10	2	-3	15	15	10	13				
COLUMBUS, OHIO TO DETROIT																			136 N.MI.			
15,000	-9	-9	-4	-4	-6	-19	-26	5	6	3	2	4	-8	-15	21	21	13	20				
10,000	-6	-7	-5	-4	-5	-15	-21	4	5	4	2	4	-6	-12	16	17	12	15				
5,000	-3	-4	-2	-2	-3	-11	-16	2	3	2	1	2	-7	-12	15	15	10	13				

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HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
COLUMBUS, OHIO TO INDIANAPOLIS																				
15,000	-41	-27	-17	-24	-26	-41	-49	40	26	17	23	25	13	6	21	21	13	20		
10,000	-30	-21	-14	-18	-20	-31	-37	29	20	14	18	20	9	4	16	17	12	15		
5,000	-16	-11	-8	-10	-11	-20	-25	15	11	7	10	10	2	-3	15	15	10	13		
COLUMBUS, OHIO TO LOUISVILLE																				
15,000	-33	-21	-13	-19	-20	-34	-42	31	19	12	17	19	7	0	20	20	12	19		
10,000	-24	-16	-10	-14	-15	-26	-32	22	14	9	13	14	4	-1	16	16	12	15		
5,000	-12	-8	-6	-7	-8	-17	-22	12	8	5	7	8	-1	-5	14	14	10	12		
COLUMBUS, OHIO TO PHILADELPHIA																				
15,000	43	28	18	24	27	14	8	-44	-30	-18	-25	-27	-42	-51	20	20	12	19		
10,000	30	22	15	19	21	11	6	-31	-23	-15	-20	-21	-32	-38	16	16	11	14		
5,000	16	12	8	10	11	3	-1	-16	-12	-8	-10	-11	-20	-25	14	14	9	12		
COLUMBUS, OHIO TO PITTSBURGH																				
15,000	41	25	17	24	25	13	6	-42	-27	-18	-25	-26	-41	-50	21	21	13	20		
10,000	29	19	13	19	20	9	4	-30	-20	-14	-19	-20	-31	-37	16	17	12	15		
5,000	15	10	7	10	10	2	-3	-16	-11	-8	-10	-11	-20	-25	15	15	10	13		
COLUMBUS, OHIO TO TOLEDO																				
15,000	-19	-15	-8	-10	-12	-25	-33	15	13	7	8	10	-2	-9	21	21	13	20		
10,000	-13	-11	-8	-8	-10	-20	-26	11	10	7	7	9	-1	-7	16	17	12	15		
5,000	-7	-6	-4	-4	-5	-14	-19	6	5	3	4	4	-4	-9	15	15	10	13		
COLUMBUS, OHIO TO WASHINGTON, D.C.																				
15,000	40	28	16	21	25	13	6	-42	-29	-17	-23	-26	-41	-49	20	20	12	19		
10,000	29	21	14	18	20	10	5	-30	-22	-14	-18	-20	-31	-37	16	16	11	15		
5,000	15	12	8	9	10	2	-2	-16	-12	-8	-9	-11	-19	-24	14	14	9	12		
CONCORD TO FITCHBURG																				
15,000	-17	-7	-6	-11	-10	-24	-32	13	5	4	9	7	-6	-13	23	22	14	21		
10,000	-9	-4	-3	-7	-5	-16	-22	6	2	2	5	4	-7	-13	18	18	12	16		
5,000	-3	-1	-3	-3	-3	-12	-17	2	1	2	3	2	-7	-13	16	15	11	13		
CONCORD TO LACONIA																				
15,000	10	2	3	7	5	-8	-16	-14	-5	-4	-9	-8	-22	-29	23	22	15	21		
10,000	4	0	0	3	2	-9	-15	-6	-2	-1	-5	-3	-14	-20	18	18	12	16		
5,000	0	0	1	2	1	-9	-14	-2	0	-2	-2	-2	-11	-16	16	16	12	13		
COMOX TO PORT HARDY																				
15,000	-21	-14	-12	-16	-15	-29	-36	19	12	11	15	14	1	-6	22	20	16	20		
10,000	-14	-9	-8	-11	-10	-20	-26	13	8	8	10	9	0	-6	18	15	12	14		
5,000	-5	0	-3	-2	-3	-11	-15	4	0	3	2	2	-6	-10	14	12	10	13		
COMOX TO VANCOUVER																				
15,000	22	14	12	17	16	3	-4	-23	-15	-12	-18	-17	-30	-37	22	20	15	19		
10,000	15	10	8	12	11	1	-4	-16	-11	-8	-12	-11	-21	-27	17	14	12	14		
5,000	6	1	3	3	3	-5	-9	-6	-2	-4	-3	-4	-11	-16	14	12	9	12		
CORPUS CHRISTI TO HOUSTON																				
15,000	23	17	4	8	11	2	-3	-24	-18	-4	-8	-12	-23	-30	16	15	10	14		
10,000	15	12	4	5	9	1	-3	-16	-12	-4	-6	-9	-17	-22	12	12	9	11		
5,000	10	8	6	4	7	0	-4	-11	-9	-6	-4	-7	-15	-19	13	12	8	11		
CORPUS CHRISTI TO SAN ANTONIO																				
15,000	-7	-7	4	-2	-2	-13	-18	5	6	-4	2	1	-8	-12	16	15	10	14		
10,000	-2	-1	4	1	1	-7	-11	1	1	-4	-2	-1	-9	-13	12	12	9	11		
5,000	3	6	9	4	6	-2	-6	-4	-6	-9	-4	-6	-13	-17	13	12	8	11		
DALLAS TO Ft. WORTH																				
15,000	-32	-25	-6	-14	-18	-32	-40	31	25	6	13	17	5	-1	19	18	11	17		
10,000	-22	-16	-5	-9	-12	-22	-28	21	16	5	9	12	2	-2	14	14	10	13		
5,000	-10	-8	-6	-5	-7	-16	-20	10	7	6	5	7	-2	-6	14	14	10	12		
DALLAS TO HOUSTON																				
15,000	6	7	0	5	4	-6	-11	-9	-9	0	-5	-5	-16	-21	17	16	10	16		
10,000	3	2	-2	3	1	-7	-11	-4	-3	2	-3	-2	-10	-15	13	13	10	12		
5,000	-1	-3	-6	-1	-3	-11	-15	0	3	5	1	3	-5	-10	13	13	9	12		

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*												STANDARD DEVIATION							
	DIRECT								RETURN					JAN	APR	JUL	OCT			
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75					A85		
DALLAS TO JACKSON																	336 N.MI.			
15,000	31	25	6	14	17	6	0	-32	-25	-6	-14	-18	-32	-39	17	17	10	16		
10,000	21	16	4	9	12	3	-2	-22	-16	-4	-9	-12	-22	-28	13	13	9	13		
5,000	10	7	5	4	6	-1	-5	-10	-8	-5	-5	-7	-15	-19	13	13	9	11		
DALLAS TO KANSAS CITY																	392 N.MI.			
15,000	9	6	3	2	5	-6	-11	-12	-8	-3	-3	-6	-17	-23	18	17	11	16		
10,000	7	5	3	2	4	-4	-9	-8	-6	-3	-3	-5	-13	-18	14	14	10	13		
5,000	4	5	6	3	5	-3	-8	-5	-6	-7	-3	-5	-13	-17	13	13	9	12		
DALLAS TO LAWTON																	129 N.MI.			
15,000	-18	-15	-3	-10	-10	-23	-30	16	14	2	9	9	-1	-7	19	18	11	17		
10,000	-12	-8	-1	-6	-6	-15	-20	10	7	1	5	6	-3	-8	14	14	10	13		
5,000	-3	-1	2	-1	0	-9	-14	2	0	-3	0	0	-8	-13	14	14	10	12		
DALLAS TO LITTLE ROCK																	256 N.MI.			
15,000	31	23	6	13	16	5	-1	-32	-24	-6	-13	-17	-31	-39	18	17	11	17		
10,000	22	16	6	9	12	3	-1	-22	-16	-6	-9	-13	-23	-28	14	14	10	13		
5,000	11	9	8	5	8	0	-4	-11	-10	-8	-5	-8	-16	-21	14	14	9	12		
DALLAS TO LUBBOCK																	254 N.MI.			
15,000	-30	-24	-5	-14	-17	-30	-38	29	24	5	13	16	5	-1	18	17	10	16		
10,000	-20	-15	-4	-9	-11	-21	-26	20	14	4	8	11	2	-2	14	13	10	12		
5,000	-8	-6	-3	-3	-5	-13	-17	7	5	3	3	4	-3	-8	13	13	9	12		
DALLAS TO MCALESTER																	133 N.MI.			
15,000	14	10	3	4	7	-3	-9	-17	-12	-4	-5	-8	-20	-27	19	18	11	17		
10,000	11	8	4	4	6	-2	-7	-12	-9	-4	-4	-7	-16	-21	14	14	10	13		
5,000	7	7	8	4	7	-2	-7	-7	-7	-8	-4	-7	-15	-20	14	14	10	12		
DALLAS TO MEMPHIS																	367 N.MI.			
15,000	33	24	6	14	17	6	0	-34	-25	-7	-14	-18	-32	-40	18	17	10	16		
10,000	23	16	6	9	13	4	-1	-24	-17	-6	-10	-13	-24	-29	13	14	10	13		
5,000	12	9	7	5	8	0	-4	-12	-10	-7	-5	-8	-16	-21	13	13	9	12		
DALLAS TO MIDLAND																	276 N.MI.			
15,000	-31	-25	-5	-12	-17	-30	-37	30	24	5	12	16	5	-1	18	16	10	15		
10,000	-21	-16	-5	-8	-12	-21	-26	20	15	4	8	11	3	-2	13	13	10	12		
5,000	-9	-7	-6	-4	-6	-14	-19	9	7	5	4	6	-1	-6	13	13	9	11		
DALLAS TO MONROE																	244 N.MI.			
15,000	31	25	6	13	17	5	0	-32	-25	-6	-14	-18	-32	-39	18	17	10	16		
10,000	21	16	4	9	12	3	-2	-22	-16	-4	-9	-12	-22	-28	14	13	10	13		
5,000	10	7	5	4	6	-2	-6	-10	-8	-5	-5	-7	-15	-19	13	13	9	12		
DALLAS TO NEW ORLEANS																	379 N.MI.			
15,000	25	21	4	11	14	3	-2	-26	-22	-4	-12	-15	-27	-34	17	16	10	15		
10,000	16	12	1	7	9	0	-4	-17	-13	-2	-7	-9	-19	-24	13	13	9	12		
5,000	6	4	1	3	3	-4	-8	-7	-5	-1	-3	-4	-11	-16	13	12	9	11		
DALLAS TO OKLAHOMA CITY																	158 N.MI.			
15,000	-7	-7	-1	-6	-5	-15	-22	4	5	0	4	3	-7	-13	19	18	11	17		
10,000	-4	-2	0	-3	-2	-11	-15	3	1	-1	2	1	-7	-12	14	14	10	13		
5,000	1	2	5	1	2	-6	-11	-1	-3	-5	-1	-3	-11	-15	14	14	10	12		
DALLAS TO SAN ANTONIO																	216 N.MI.			
15,000	-17	-12	-4	-5	-9	-19	-25	15	11	4	4	8	-2	-7	17	16	10	15		
10,000	-13	-10	-5	-3	-7	-16	-21	12	9	5	3	7	-1	-6	13	13	10	12		
5,000	-8	-8	-9	-5	-8	-15	-20	8	8	9	4	8	0	-5	13	13	9	12		
DALLAS TO SHREVEPORT																	155 N.MI.			
15,000	31	24	5	13	17	5	-1	-31	-25	-6	-14	-17	-31	-39	18	17	11	16		
10,000	21	15	4	9	11	2	-3	-21	-16	-4	-9	-12	-22	-27	14	14	10	13		
5,000	9	6	4	4	6	-2	-7	-10	-7	-4	-4	-6	-14	-19	14	13	9	12		
DALLAS TO TULSA																	207 N.MI.			
15,000	8	5	2	1	4	-6	-12	-11	-7	-2	-3	-5	-16	-23	19	18	11	17		
10,000	6	5	3	2	4	-5	-9	-8	-6	-3	-3	-5	-13	-18	14	14	10	13		
5,000	5	5	7	3	5	-3	-8	-6	-6	-7	-3	-6	-14	-18	14	14	10	12		

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*								STANDARD DEVIATION									
	D I R E C T								R E T U R N									
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
DALLAS TO WACO																		
15,000	-13	-9	-4	-3	-7	-17	-24	10	7	3	2	5	-5	-10	18	17	77 N.MI.	16
10,000	-10	-8	-4	-3	-6	-14	-19	9	7	4	2	5	-3	-8	14	14	10	13
5,000	-7	-7	-9	-4	-7	-15	-19	6	7	9	4	7	-2	-6	14	13	9	12
DALLAS TO WICHITA FALLS																		
15,000	-24	-19	-4	-12	-13	-26	-34	22	18	3	11	12	1	-4	19	17	107 N.MI.	17
10,000	-15	-11	-2	-7	-8	-18	-23	14	10	2	7	8	-1	-6	14	14	10	13
5,000	-5	-3	0	-2	-2	-11	-15	4	2	-1	1	2	-7	-11	14	14	10	12
DANVILLE TO GREENSBORO																		
15,000	-32	-21	-9	-17	-18	-32	-41	30	19	8	16	17	5	-1	20	20	41 N.MI.	19
10,000	-21	-15	-7	-12	-13	-24	-30	20	14	7	11	12	2	-3	16	17	11	15
5,000	-11	-8	-4	-5	-7	-15	-20	10	7	4	4	6	-2	-6	14	13	9	13
DANVILLE TO RICHMOND																		
15,000	36	24	12	19	21	9	3	-37	-26	-12	-20	-22	-37	-45	20	20	112 N.MI.	19
10,000	25	18	10	14	16	6	1	-26	-19	-10	-15	-17	-28	-34	16	17	11	15
5,000	13	10	6	6	8	0	-4	-14	-10	-6	-6	-9	-17	-22	14	13	9	13
DAYTON TO FT. WAYNE																		
15,000	-25	-18	-11	-14	-16	-30	-37	22	16	10	12	14	2	-5	21	21	79 N.MI.	20
10,000	-18	-14	-10	-11	-13	-23	-29	16	13	9	10	12	1	-4	16	17	12	15
5,000	-9	-7	-5	-6	-7	-15	-21	8	7	4	5	6	-3	-7	15	15	10	13
DAYTON TO INDIANAPOLIS																		
15,000	-41	-27	-17	-24	-26	-41	-49	40	26	17	23	25	12	6	21	21	96 N.MI.	20
10,000	-30	-21	-14	-18	-20	-31	-37	29	20	13	17	19	9	3	16	17	12	15
5,000	-16	-11	-8	-10	-11	-20	-25	15	11	7	10	10	2	-3	15	15	10	13
DAYTON TO PITTSBURGH																		
15,000	41	26	17	24	25	13	6	-42	-27	-18	-25	-26	-41	-50	21	21	187 N.MI.	20
10,000	29	20	14	18	20	9	4	-30	-21	-14	-19	-20	-31	-37	16	17	12	15
5,000	15	11	7	10	10	2	-3	-16	-11	-8	-10	-11	-20	-25	14	14	10	12
DAYTON TO ST. LOUIS																		
15,000	-39	-26	-16	-22	-24	-38	-46	38	25	15	21	23	11	5	19	20	294 N.MI.	19
10,000	-28	-20	-13	-16	-19	-29	-35	28	19	12	16	18	8	3	15	16	11	14
5,000	-15	-11	-7	-9	-10	-19	-24	15	10	7	9	10	1	-3	14	14	10	12
DAYTON TO WASHINGTON, D.C.																		
15,000	41	28	17	22	25	13	7	-42	-29	-17	-23	-26	-40	-49	20	20	339 N.MI.	19
10,000	29	21	14	18	20	10	5	-30	-22	-14	-18	-21	-31	-37	15	16	11	14
5,000	15	12	8	9	10	2	-2	-16	-12	-8	-9	-11	-19	-24	14	14	9	12
DAYTONA BEACH TO JACKSONVILLE																		
15,000	-11	-10	1	-3	-5	-16	-22	9	8	-1	2	4	-5	-10	17	17	80 N.MI.	15
10,000	-5	-6	2	-1	-2	-11	-15	3	5	-2	0	1	-7	-11	14	14	9	13
5,000	3	0	1	0	1	-6	-10	-3	0	-2	-1	-1	-9	-13	12	12	8	11
DAYTONA BEACH TO LAKE LAND																		
15,000	-15	-12	-4	-8	-9	-19	-25	14	11	4	7	8	-1	-5	16	16	87 N.MI.	14
10,000	-11	-9	-4	-6	-7	-15	-20	11	8	4	5	7	-1	-5	13	13	9	12
5,000	-8	-7	-4	-4	-6	-13	-17	7	7	4	4	5	-1	-5	12	11	8	11
DAYTONA BEACH TO MELBOURNE																		
15,000	8	7	-3	0	2	-7	-11	-9	-9	3	-1	-3	-13	-19	16	16	69 N.MI.	14
10,000	2	4	-3	-1	0	-8	-12	-3	-4	3	1	0	-9	-13	13	13	9	12
5,000	-6	-2	-3	-3	-4	-10	-14	5	2	3	3	3	-4	-8	12	11	8	11
DAYTONA BEACH TO MIAMI																		
15,000	5	5	-4	-1	0	-8	-12	-6	-6	4	1	-1	-10	-16	15	14	207 N.MI.	13
10,000	0	2	-4	-3	-2	-9	-13	-1	-2	4	3	1	-6	-10	12	12	8	11
5,000	-6	-4	-4	-4	-5	-11	-15	6	4	4	4	4	-2	-6	11	11	7	10
DAYTONA BEACH TO ORLANDO																		
15,000	-10	-8	-4	-6	-7	-16	-21	8	7	4	6	6	-3	-8	16	16	41 N.MI.	14
10,000	-9	-6	-4	-5	-6	-14	-18	8	5	4	5	5	-2	-7	14	13	9	12
5,000	-8	-6	-4	-4	-5	-13	-17	7	6	4	4	5	-2	-6	12	12	8	11

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*										STANDARD DEVIATION			
	D I R E C T					R E T U R N					JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85
DAYTONA BEACH TO TAMPA														
15,000	-19	-16	-4	-9	-11	-21	-27	17	15	4	8	10	1	-3
10,000	-13	-10	-4	-6	-8	-16	-21	13	10	4	6	7	0	-4
5,000	-7	-7	-4	-4	-6	-13	-17	7	7	4	4	5	-2	-5
DAYTONA BEACH TO WEST PALM BEACH														
15,000	8	7	-3	0	2	-7	-11	-9	-8	3	0	-3	-12	-18
10,000	1	3	-4	-2	-1	-8	-12	-2	-4	4	2	0	-8	-12
5,000	-6	-3	-4	-4	-4	-11	-15	6	3	4	3	4	-3	-6
DENVER TO GRAND JUNCTION														
15,000	-23	-18	-14	-15	-17	-28	-34	22	17	14	14	16	6	0
10,000	-13	-11	-8	-10	-10	-18	-22	13	10	8	10	10	2	-2
5,000	-1	-2	-2	-2	-2	-7	-10	1	2	1	2	2	-4	-7
DENVER TO LINCOLN														
15,000	26	20	16	18	19	9	3	-27	-20	-16	-19	-20	-32	-38
10,000	18	13	10	12	13	4	0	-18	-13	-10	-12	-13	-22	-27
5,000	7	7	6	8	7	0	-4	-8	-7	-6	-8	-7	-15	-19
DENVER TO LUBBOCK														
15,000	11	7	2	7	6	-4	-9	-13	-9	-2	-8	-7	-18	-24
10,000	8	4	1	4	4	-4	-8	-9	-5	-1	-4	-4	-12	-17
5,000	-2	-3	-6	-4	-4	-11	-14	2	3	6	4	4	-3	-7
DENVER TO OMAHA														
15,000	26	20	16	18	19	9	3	-27	-20	-16	-19	-20	-32	-38
10,000	18	13	10	12	13	4	0	-18	-13	-10	-12	-13	-22	-27
5,000	7	7	6	8	7	0	-4	-8	-7	-6	-8	-7	-15	-19
DENVER TO RAPID CITY														
15,000	2	3	6	2	4	-7	-14	-4	-4	-7	-3	-5	-16	-21
10,000	1	1	4	1	2	-7	-11	-2	-1	-4	-1	-2	-10	-15
5,000	6	4	5	5	5	-2	-6	-6	-5	-5	-5	-5	-12	-16
DENVER TO SALT LAKE CITY														
15,000	-23	-17	-13	-16	-17	-27	-34	22	16	13	15	16	6	0
10,000	-13	-10	-7	-10	-10	-17	-21	13	10	7	10	10	2	-1
5,000	3	1	2	2	2	-3	-5	-3	-1	-2	-2	-2	-7	-9
DENVER TO WICHITA														
15,000	27	20	12	17	18	8	2	-28	-21	-13	-18	-19	-31	-37
10,000	19	13	8	12	12	4	0	-19	-14	-8	-12	-13	-22	-26
5,000	6	5	3	6	5	-2	-6	-7	-5	-3	-6	-5	-13	-17
DES MOINES TO KANSAS CITY														
15,000	-9	-7	-5	-3	-6	-18	-25	5	5	4	2	4	-8	-14
10,000	-6	-4	-4	-3	-4	-14	-19	4	3	3	2	3	-7	-12
5,000	-2	-3	-4	-2	-3	-12	-16	1	3	4	2	2	-6	-11
DES MOINES TO MINNEAPOLIS														
15,000	-3	-2	0	-3	-2	-14	-20	0	0	-1	1	0	-12	-18
10,000	-3	-2	-1	-2	-2	-11	-17	1	1	0	1	1	-9	-14
5,000	-2	-2	1	-1	-1	-10	-15	1	1	-2	0	0	-9	-13
DES MOINES TO OMAHA														
15,000	-31	-21	-17	-20	-22	-34	-41	29	20	16	19	21	9	3
10,000	-22	-15	-12	-14	-15	-25	-31	21	14	11	13	15	5	0
5,000	-11	-8	-7	-9	-9	-17	-22	10	8	7	9	8	0	-5
DES MOINES TO ST. LOUIS														
15,000	24	16	11	16	16	4	-2	-26	-17	-12	-17	-17	-30	-37
10,000	18	13	8	11	12	2	-3	-19	-13	-9	-12	-13	-23	-28
5,000	9	6	3	6	6	-3	-7	-10	-7	-4	-7	-7	-15	-20
DES MOINES TO WATERLOO														
15,000	18	13	11	11	13	1	-6	-21	-14	-12	-13	-15	-27	-34
10,000	13	9	8	8	10	0	-6	-15	-10	-9	-9	-10	-20	-26
5,000	6	4	5	6	5	-4	-9	-7	-5	-6	-6	-6	-15	-20

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
DETROIT TO FLINT																		
15,000	-17	-14	-10	-10	-12	-25	-33	14	11	8	8	10	-2	-9	47 N.MI.			
10,000	-12	-10	-8	-8	-9	-20	-26	10	9	7	7	8	-2	-8	22	21	14	21
5,000	-7	-6	-4	-4	-5	-14	-19	6	5	4	3	4	-5	-10	17	18	13	16
DETROIT TO GRAND RAPIDS																		
15,000	-37	-24	-19	-23	-25	-39	-46	35	23	19	21	24	11	4	110 N.MI.			
10,000	-26	-18	-15	-17	-19	-30	-36	26	18	14	17	18	8	2	21	21	14	20
5,000	-15	-10	-8	-10	-10	-20	-25	14	9	8	9	10	1	-4	16	17	12	15
DETROIT TO INDIANAPOLIS																		
15,000	-27	-16	-12	-16	-17	-30	-38	24	14	11	14	15	3	-3	200 N.MI.			
10,000	-20	-12	-9	-12	-13	-23	-29	18	11	8	11	12	2	-4	20	21	13	20
5,000	-10	-6	-5	-7	-7	-16	-21	10	6	5	7	6	-2	-7	16	17	12	15
DETROIT TO LAND O LAKES																		
15,000	-29	-19	-17	-19	-20	-33	-40	26	18	17	17	19	7	1	344 N.MI.			
10,000	-21	-14	-13	-14	-16	-25	-31	20	13	13	14	15	5	0	20	19	13	19
5,000	-12	-8	-7	-8	-8	-17	-22	11	7	6	7	8	-1	-5	15	16	12	15
DETROIT TO LANSING																		
15,000	-34	-23	-18	-21	-23	-37	-45	33	22	17	20	22	9	3	64 N.MI.			
10,000	-25	-18	-14	-16	-18	-29	-35	24	17	14	16	17	7	1	21	21	14	20
5,000	-14	-10	-8	-9	-10	-19	-24	13	9	7	8	9	0	-5	16	17	13	16
DETROIT TO LOUISVILLE																		
15,000	-19	-10	-7	-11	-11	-23	-30	15	7	6	9	9	-3	-9	266 N.MI.			
10,000	-13	-7	-5	-8	-8	-18	-23	11	6	4	7	7	-3	-8	20	20	12	19
5,000	-7	-4	-3	-4	-4	-13	-17	6	3	3	4	4	-5	-9	15	16	12	15
DETROIT TO MILWAUKEE																		
15,000	-37	-25	-20	-23	-25	-39	-46	36	24	19	22	24	12	6	206 N.MI.			
10,000	-27	-19	-15	-18	-19	-30	-36	27	18	15	17	19	9	3	21	20	13	20
5,000	-15	-10	-8	-10	-11	-20	-25	14	9	8	10	10	1	-3	16	17	12	15
DETROIT TO PHILADELPHIA																		
15,000	38	27	18	21	25	12	6	-39	-28	-18	-22	-26	-39	-47	393 N.MI.			
10,000	28	20	15	18	19	10	5	-28	-21	-15	-18	-20	-31	-36	20	20	12	19
5,000	15	11	8	9	10	2	-2	-15	-12	-9	-10	-11	-19	-24	16	16	11	14
DETROIT TO PITTSBURGH																		
15,000	32	23	15	18	21	9	2	-34	-24	-16	-19	-22	-36	-44	176 N.MI.			
10,000	23	17	13	15	17	7	1	-24	-18	-13	-16	-18	-28	-34	21	21	13	20
5,000	12	10	7	8	9	0	-4	-13	-10	-7	-8	-9	-18	-23	16	17	12	15
DETROIT TO ROCHESTER, N.Y.																		
15,000	38	23	19	23	25	12	6	-39	-24	-19	-24	-26	-40	-48	256 N.MI.			
10,000	28	17	14	18	19	9	3	-28	-18	-15	-19	-20	-30	-36	21	21	13	20
5,000	15	10	8	10	11	2	-3	-16	-10	-9	-11	-11	-20	-25	16	17	12	15
DETROIT TO ST. LOUIS																		
15,000	-33	-21	-15	-19	-21	-34	-41	31	20	14	17	20	8	2	382 N.MI.			
10,000	-24	-16	-11	-15	-16	-26	-32	23	15	11	14	15	6	1	19	19	12	19
5,000	-13	-8	-7	-9	-9	-17	-22	12	8	6	8	8	0	-4	15	16	11	14
DETROIT TO TOLEDO																		
15,000	-19	-10	-8	-12	-12	-25	-32	15	7	7	10	9	-3	-10	44 N.MI.			
10,000	-13	-7	-5	-9	-8	-19	-25	11	6	5	7	7	-3	-9	22	21	14	21
5,000	-7	-3	-3	-5	-5	-14	-19	6	3	3	5	4	-5	-10	17	17	12	16
DETROIT TO WASHINGTON, D.C.																		
15,000	33	24	15	17	21	9	3	-35	-26	-16	-19	-23	-36	-44	352 N.MI.			
10,000	24	19	13	15	17	8	2	-25	-19	-14	-16	-18	-28	-34	20	20	12	19
5,000	13	10	7	8	9	1	-3	-13	-11	-7	-8	-10	-18	-23	16	16	11	14
DOTHAN TO MONTGOMERY																		
15,000	-17	-16	-4	-8	-10	-22	-29	15	15	3	7	9	-1	-7	80 N.MI.			
10,000	-11	-10	0	-5	-6	-16	-21	10	9	0	5	5	-3	-8	18	18	10	17
5,000	-3	-3	-1	-2	-2	-10	-14	2	3	0	2	2	-6	-10	14	15	10	14

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
EDMONTON TO GRAND PRAIRIE																		
15,000	-23	-12	-10	-19	-16	-27	-33	22	12	10	18	15	4	-1	17	16	14	15
10,000	-17	-10	-9	-15	-12	-21	-25	16	9	8	15	12	4	-1	14	12	10	12
5,000	-8	-2	-3	-8	-5	-13	-17	7	1	3	7	4	-4	-8	13	12	10	12
EDMONTON TO REGINA																		
15,000	25	15	14	20	18	8	3	-26	-15	-15	-21	-19	-29	-35	16	15	13	15
10,000	19	11	11	16	14	6	2	-20	-11	-11	-17	-14	-22	-27	12	11	10	11
5,000	10	3	3	9	6	-2	-6	-11	-3	-4	-9	-7	-15	-20	13	12	11	12
EDMONTON TO SASKATOON																		
15,000	25	15	15	20	18	8	3	-26	-16	-15	-21	-19	-29	-35	16	15	13	15
10,000	19	11	10	16	14	6	2	-19	-11	-11	-16	-14	-22	-27	13	12	10	12
5,000	11	3	4	10	7	-2	-6	-12	-4	-4	-10	-7	-16	-21	14	12	11	13
ELKO TO ELY																		
15,000	12	8	1	6	6	-5	-11	-14	-9	-2	-7	-7	-19	-26	21	18	12	18
10,000	8	5	-1	4	3	-5	-9	-8	-5	0	-4	-4	-13	-17	14	13	10	12
5,000	-5	-4	-1	-4	-3	-8	-11	4	4	1	4	3	-2	-5	9	8	6	8
ELKO TO RENO																		
15,000	-20	-14	-14	-13	-15	-26	-33	18	13	14	12	14	3	-4	21	18	12	18
10,000	-13	-9	-8	-9	-9	-18	-23	12	8	8	8	9	1	-4	15	13	9	13
5,000	-4	-4	0	-5	-3	-9	-12	4	4	0	4	3	-3	-5	10	8	6	8
ELMIRA TO ROCHESTER, N.Y.																		
15,000	-20	-17	-12	-11	-15	-28	-36	16	15	11	9	12	0	-7	22	22	14	21
10,000	-16	-13	-10	-10	-12	-23	-29	14	12	10	9	11	0	-5	17	18	12	16
5,000	-9	-8	-6	-5	-7	-16	-21	8	7	6	4	6	-3	-8	15	15	11	13
ELMIRA TO WILLIAMSPORT																		
15,000	-5	1	0	-5	-2	-15	-22	1	-4	-1	5	-1	-13	-21	22	22	14	21
10,000	-2	2	1	-2	0	-10	-16	-1	-3	-2	0	-2	-12	-18	17	18	12	16
5,000	-1	1	1	-1	0	-9	-14	-1	-2	-1	0	-1	-10	-15	15	15	11	13
EL PASO TO MIOLANO																		
15,000	27	23	3	10	14	3	-2	-28	-23	-4	-11	-15	-28	-35	18	16	10	15
10,000	17	14	3	6	9	1	-3	-18	-14	-3	-7	-10	-19	-24	13	12	9	11
5,000	4	3	1	-1	1	-5	-9	-4	-3	-1	1	-2	-8	-12	11	11	7	10
EL PASO TO PHOENIX																		
15,000	-24	-19	-2	-9	-12	-24	-32	23	19	1	9	11	1	-4	18	15	10	14
10,000	-14	-11	-2	-5	-7	-15	-20	14	11	1	4	7	-1	-4	13	11	8	10
5,000	2	2	3	5	3	-2	-5	-2	-2	-3	-5	-3	-8	-11	8	8	5	8
EL PASO TO ROSWELL																		
15,000	19	16	7	8	11	2	-4	-20	-17	-7	-8	-12	-23	-30	18	16	10	15
10,000	12	10	5	6	8	0	-4	-13	-11	-5	-6	-8	-17	-21	14	12	9	11
5,000	6	6	6	2	5	-1	-5	-7	-6	-6	-2	-5	-12	-15	11	10	7	10
EL PASO TO TUCSON																		
15,000	-25	-21	-2	-10	-13	-26	-33	24	21	2	9	13	2	-3	18	15	10	14
10,000	-15	-12	-2	-5	-8	-16	-21	14	12	2	5	8	0	-4	13	11	8	11
5,000	1	0	1	5	2	-3	-6	-1	-1	-2	-5	-2	-7	-10	9	9	5	8
ELY TO SALT LAKE CITY																		
15,000	15	12	13	10	13	2	-4	-16	-13	-14	-11	-14	-24	-31	20	17	12	17
10,000	9	7	8	7	8	0	-4	-10	-8	-8	-8	-8	-16	-20	13	12	10	11
5,000	1	3	0	2	1	-3	-6	-1	-3	0	-2	-2	-6	-9	8	8	6	7
EUGENE TO MEDFORD																		
15,000	6	2	1	1	2	-10	-17	-8	-3	-2	-3	-4	-16	-23	22	20	13	20
10,000	2	0	0	0	1	-9	-14	-4	-1	0	-1	-1	-11	-16	17	15	11	14
5,000	-3	-2	4	-3	-1	-8	-12	3	2	-4	2	0	-7	-10	13	10	8	10
EUGENE TO SALEM																		
15,000	0	3	3	4	3	-10	-17	-3	-5	-4	-6	-4	-17	-24	23	21	14	20
10,000	4	4	2	3	3	-6	-12	-5	-5	-3	-4	-4	-14	-19	17	15	11	15
5,000	6	3	-3	5	2	-5	-9	-6	-4	3	-5	-2	-10	-15	13	11	8	11

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HEIGHT IN FEET	EQUIVALENT								HEAD WINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
EVANSVILLE TO INDIANAPOLIS																				
15,000	19	11	7	9	11	-1	-7	-23	-13	-8	-11	-13	-26	-33	20	21	12	20	117 N.MI.	
10,000	14	9	6	8	9	-1	-6	-16	-10	-6	-9	-10	-20	-26	15	16	12	15		
5,000	7	5	4	4	5	-4	-8	-8	-6	-4	-5	-5	-14	-19	15	15	10	13		
EVANSVILLE TO LOUISVILLE																				
15,000	39	26	14	20	23	10	4	-40	-27	-14	-21	-24	-39	-47	20	20	12	20	85 N.MI.	
10,000	28	20	11	15	18	8	2	-29	-20	-12	-16	-18	-30	-35	15	16	12	15		
5,000	15	11	7	8	10	1	-4	-15	-11	-7	-8	-10	-19	-24	15	15	10	13		
EVANSVILLE TO NASHVILLE																				
15,000	7	8	4	6	6	-5	-12	-11	-11	-4	-7	-8	-20	-27	20	20	12	19	122 N.MI.	
10,000	6	6	3	4	5	-5	-10	-8	-8	-3	-5	-6	-15	-21	15	16	11	15		
5,000	3	3	2	2	2	-6	-11	-4	-3	-2	-3	-3	-11	-16	15	14	10	13		
EVANSVILLE TO OWENSBORO																				
15,000	23	18	9	14	15	3	-3	-26	-20	-10	-15	-17	-30	-38	21	21	12	20	25 N.MI.	
10,000	18	14	7	10	12	2	-4	-19	-15	-8	-11	-13	-23	-29	16	17	12	15		
5,000	9	7	4	5	6	-3	-7	-10	-8	-4	-6	-7	-16	-21	15	15	10	13		
EVANSVILLE TO PADUCAH																				
15,000	-31	-19	-9	-14	-17	-31	-39	28	18	9	13	16	4	-3	20	20	12	20	83 N.MI.	
10,000	-22	-14	-8	-11	-13	-24	-30	20	13	8	10	12	2	-3	15	16	11	15		
5,000	-11	-8	-5	-6	-7	-16	-21	11	8	5	5	7	-2	-6	15	15	10	13		
EVANSVILLE TO ST. LOUIS																				
15,000	-37	-25	-14	-21	-23	-37	-45	35	24	13	20	22	9	3	20	20	12	19	140 N.MI.	
10,000	-27	-19	-11	-15	-17	-28	-34	26	19	10	14	17	7	1	15	16	12	15		
5,000	-14	-10	-6	-8	-9	-18	-24	14	10	6	8	9	0	-4	15	15	10	13		
FARGO TO GRAND FORKS																				
15,000	-13	-10	-6	-10	-9	-21	-28	10	8	5	9	8	-4	-10	19	19	14	18	62 N.MI.	
10,000	-11	-8	-6	-8	-8	-18	-23	10	7	5	7	7	-2	-7	14	15	12	15		
5,000	-7	-4	-1	-6	-4	-14	-19	6	3	1	5	4	-6	-11	14	15	12	15		
FARGO TO JAMESTOWN																				
15,000	-28	-18	-21	-24	-22	-34	-41	27	17	20	23	22	10	4	19	19	14	18	76 N.MI.	
10,000	-21	-12	-15	-16	-16	-26	-31	20	11	14	16	15	6	1	14	15	12	15		
5,000	-11	-5	-6	-10	-8	-17	-23	11	4	6	9	7	-2	-7	14	14	12	15		
FARGO TO MINNEAPOLIS																				
15,000	25	17	17	20	20	8	2	-27	-18	-18	-22	-21	-33	-39	19	19	13	18	194 N.MI.	
10,000	20	13	13	15	15	6	0	-21	-13	-13	-15	-16	-25	-31	14	15	12	14		
5,000	12	6	5	9	8	-1	-6	-12	-6	-5	-10	-8	-18	-23	14	14	12	14		
FARGO TO WINNIPEG																				
15,000	-11	-8	-4	-9	-8	-19	-25	8	7	3	7	6	-5	-11	18	18	14	18	180 N.MI.	
10,000	-9	-7	-4	-7	-7	-16	-21	8	6	4	6	6	-3	-8	14	14	12	14		
5,000	-5	-3	-1	-5	-3	-12	-17	5	2	0	4	3	-6	-11	14	14	12	14		
FLINT TO GRAND RAPIDS																				
15,000	-38	-24	-20	-24	-25	-40	-47	37	23	19	23	25	12	5	21	21	14	20	84 N.MI.	
10,000	-27	-18	-15	-18	-19	-30	-36	27	17	15	18	19	8	3	16	17	13	16		
5,000	-15	-10	-9	-11	-11	-20	-25	15	9	8	10	10	1	-4	15	16	11	13		
FLINT TO SAGINAW																				
15,000	-18	-14	-11	-11	-13	-26	-33	14	12	9	9	11	-2	-9	22	21	14	21	37 N.MI.	
10,000	-13	-10	-8	-9	-10	-20	-26	11	9	8	7	9	-2	-7	17	18	13	16		
5,000	-7	-6	-4	-4	-5	-14	-20	6	5	4	3	5	-5	-10	15	16	11	13		
FLORENCE TO RALEIGH																				
15,000	19	11	4	10	10	-1	-7	-23	-14	-5	-11	-12	-25	-32	19	19	11	19	111 N.MI.	
10,000	11	8	4	7	7	-2	-7	-13	-10	-4	-8	-8	-18	-23	15	16	10	15		
5,000	6	4	2	2	3	-5	-9	-7	-5	-2	-2	-4	-12	-16	14	13	9	13		
FT. LAUDERDALE TO MIAMI																				
15,000	-4	-4	-3	-5	-4	-12	-16	3	3	3	4	3	-4	-9	15	14	8	12	17 N.MI.	
10,000	-4	-3	-3	-5	-4	-11	-14	4	3	3	4	3	-3	-7	12	11	7	10		
5,000	-3	-5	-4	-3	-4	-10	-14	3	5	3	3	3	-3	-7	11	10	7	10		

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
FT. LAUDERDALE TO WEST PALM BEACH																		
15,000	-1	-1	4	3	2	-7	-11	0	0	-4	-4	-2	-10	-14	15	14	8	12
10,000	2	1	4	4	3	-4	-8	-3	-1	-4	-4	-3	-10	-14	13	12	8	11
5,000	5	5	4	4	4	-2	-6	-5	-5	-5	-4	-5	-11	-15	11	10	7	10
FT. MEYERS TO SARASOTA																		
15,000	-13	-13	3	-3	-5	-16	-22	12	12	-3	2	4	-5	-9	15	14	8	13
10,000	-5	-6	4	0	-1	-9	-14	4	5	-4	-1	1	-7	-11	13	12	8	11
5,000	6	2	4	4	4	-3	-7	-6	-2	-4	-4	-4	-11	-14	11	11	8	10
FT. MEYERS TO WEST PALM BEACH																		
15,000	18	17	-1	7	9	0	-5	-19	-18	0	-7	-9	-21	-27	15	14	8	12
10,000	9	10	-1	3	5	-3	-7	-10	-10	1	-4	-5	-13	-18	12	12	8	11
5,000	-2	3	-1	-1	0	-7	-10	1	-3	0	1	0	-7	-10	11	10	7	10
FT. NELSON TO FT. ST. JOHN																		
15,000	9	3	4	6	5	-5	-10	-11	-3	-4	-7	-6	-16	-22	17	15	13	15
10,000	7	2	4	4	4	-4	-8	-8	-3	-4	-5	-5	-13	-17	14	11	10	12
5,000	-2	-2	-1	1	-1	-9	-13	1	2	1	-1	1	-7	-11	13	11	10	13
FT. ST. JOHN TO GRAND PRAIRIE																		
15,000	17	8	6	14	11	0	-5	-17	-9	-7	-14	-12	-23	-29	17	16	14	16
10,000	13	7	6	12	9	1	-3	-13	-7	-7	-12	-10	-18	-23	14	12	10	12
5,000	3	-1	1	5	2	-6	-10	-3	1	-2	-5	-2	-10	-15	13	12	10	13
FT. ST. JOHN TO PRINCE GEORGE																		
15,000	-7	-7	-4	-11	-7	-18	-24	6	6	3	9	6	-5	-11	18	16	14	16
10,000	-6	-6	-3	-9	-6	-14	-19	5	5	2	9	5	-3	-8	15	12	10	13
5,000	-9	-6	-3	-8	-6	-14	-19	9	6	3	7	6	-2	-6	13	12	10	12
FT. SMITH TO LITTLE ROCK																		
15,000	31	24	7	15	18	6	0	-33	-25	-7	-16	-19	-33	-41	20	19	11	18
10,000	22	16	5	11	13	3	-2	-23	-17	-6	-11	-13	-24	-30	15	15	10	14
5,000	10	8	6	5	7	-2	-6	-10	-8	-6	-5	-7	-16	-21	14	15	10	12
FT. SMITH TO TEXARKANA																		
15,000	0	3	1	3	2	-9	-15	-3	-5	-1	-4	-3	-14	-20	19	18	11	18
10,000	0	1	-1	1	0	-9	-13	-2	-2	1	-2	-1	-10	-15	14	14	10	14
5,000	-2	-2	-3	-1	-2	-10	-15	1	2	3	0	2	-7	-12	14	14	10	12
FT. SMITH TO TULSA																		
15,000	-28	-22	-7	-15	-16	-30	-38	26	20	7	14	15	4	-2	20	19	11	18
10,000	-19	-14	-5	-10	-12	-21	-27	18	13	5	9	11	1	-3	15	15	11	14
5,000	-8	-6	-4	-4	-5	-14	-19	7	5	3	4	5	-4	-8	14	15	10	13
FT. WAYNE TO INDIANAPOLIS																		
15,000	-24	-14	-10	-13	-14	-28	-35	20	12	9	11	12	0	-6	21	21	13	20
10,000	-17	-11	-7	-10	-11	-21	-27	15	9	6	9	10	0	-6	16	17	12	15
5,000	-9	-5	-4	-6	-6	-15	-20	8	5	4	5	5	-3	-8	15	15	10	13
FT. WAYNE TO SOUTH BEND																		
15,000	-31	-22	-15	-19	-21	-35	-42	29	20	14	18	19	7	0	21	21	13	20
10,000	-23	-17	-12	-14	-16	-27	-33	21	16	12	13	15	5	-1	16	17	12	15
5,000	-12	-9	-6	-8	-8	-18	-23	11	8	6	7	8	-1	-6	15	15	11	13
FT. WAYNE TO TOLEDO																		
15,000	33	20	15	20	21	8	2	-35	-22	-16	-21	-22	-37	-44	21	21	13	20
10,000	24	15	11	15	16	6	0	-25	-16	-12	-16	-17	-28	-34	16	17	12	15
5,000	13	8	7	9	9	0	-5	-13	-8	-7	-9	-9	-18	-24	15	15	10	13
FT. WILLIAM TO SAULT STE. MARIE																		
15,000	28	18	21	20	21	9	3	-29	-19	-21	-21	-22	-34	-41	19	19	14	19
10,000	21	13	15	16	16	6	1	-22	-13	-15	-16	-17	-27	-32	15	16	13	15
5,000	12	7	8	10	9	0	-5	-12	-7	-8	-10	-9	-19	-24	14	15	12	14
FT. WILLIAM TO WINNIPEG																		
15,000	-28	-18	-21	-22	-22	-33	-40	27	17	21	21	22	10	4	18	17	13	17
10,000	-21	-12	-16	-17	-17	-26	-31	21	12	15	17	16	7	2	13	14	12	14
5,000	-11	-5	-7	-11	-9	-18	-23	10	4	7	11	8	-1	-6	14	14	12	14

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
FT. WORTH TO HOUSTON																		
15,000	8	8	0	5	4	-5	-10	-10	-10	0	-6	-6	-16	-22	17	16	212 N.MI.	16
10,000	4	3	-2	3	2	-6	-11	-5	-4	2	-3	-2	-11	-15	13	13	10	12
5,000	-1	-3	-5	-1	-3	-10	-14	0	2	5	1	2	-6	-10	13	13	9	12
FT. WORTH TO LITTLE ROCK																		
15,000	31	23	6	13	16	5	-1	-32	-24	-6	-13	-17	-31	-39	18	17	266 N.MI.	17
10,000	22	16	6	9	12	3	-1	-22	-16	-6	-9	-13	-23	-28	14	14	10	13
5,000	11	9	8	5	8	0	-4	-11	-10	-8	-5	-8	-16	-21	13	13	9	12
FT. WORTH TO NEW ORLEANS																		
15,000	25	21	4	11	14	3	-2	-27	-22	-4	-12	-15	-27	-34	16	16	387 N.MI.	15
10,000	17	12	1	7	9	0	-4	-17	-13	-2	-7	-9	-19	-24	13	13	9	12
5,000	7	4	1	3	3	-4	-8	-7	-5	-1	-3	-4	-12	-16	13	12	8	11
FT. WORTH TO OKLAHOMA CITY																		
15,000	-5	-5	0	-5	-3	-14	-20	2	3	0	4	2	-8	-14	19	18	157 N.MI.	17
10,000	-3	-1	1	-2	-1	-10	-14	1	0	-1	1	0	-8	-13	14	14	10	13
5,000	1	3	5	1	3	-6	-10	-2	-3	-6	-2	-3	-12	-16	14	14	10	12
FT. WORTH TO SHREVEPORT																		
15,000	31	24	5	13	17	5	-1	-32	-25	-6	-14	-17	-31	-39	18	17	165 N.MI.	16
10,000	21	15	4	9	11	2	-2	-21	-16	-4	-9	-12	-22	-27	14	14	10	13
5,000	9	7	4	4	6	-2	-7	-10	-7	-4	-4	-6	-14	-19	14	13	9	12
FT. WORTH TO WACO																		
15,000	-9	-6	-3	-1	-5	-15	-21	6	4	3	0	3	-7	-13	18	17	74 N.MI.	16
10,000	-7	-6	-4	-2	-4	-13	-18	6	5	3	1	4	-5	-9	14	14	10	13
5,000	-6	-7	-9	-4	-6	-14	-19	5	6	8	3	6	-2	-7	14	13	9	12
FT. WORTH TO WICHITA FALLS																		
15,000	-22	-18	-3	-11	-12	-25	-32	20	17	3	10	11	0	-5	19	17	100 N.MI.	17
10,000	-14	-10	-2	-7	-8	-17	-22	13	9	2	6	7	-2	-6	14	14	10	13
5,000	-4	-2	1	-1	-1	-10	-15	4	2	-1	1	1	-7	-12	14	14	10	12
FREDERICTON TO MONTREAL																		
15,000	-35	-23	-23	-27	-27	-40	-47	34	22	22	26	26	13	6	21	21	303 N.MI.	20
10,000	-27	-16	-17	-20	-19	-30	-36	26	15	16	19	19	9	3	17	17	12	15
5,000	-15	-10	-12	-12	-12	-21	-26	14	9	12	12	12	3	-2	15	15	11	13
FREDERICTON TO QUEBEC																		
15,000	-31	-21	-23	-25	-25	-38	-46	30	20	22	23	24	10	3	22	21	209 N.MI.	21
10,000	-25	-15	-17	-19	-19	-30	-35	24	14	16	19	18	8	2	18	16	12	16
5,000	-15	-9	-12	-12	-12	-21	-26	14	9	11	12	12	2	-3	16	15	12	13
FREDERICTON TO ST. JOHN																		
15,000	16	12	14	12	14	0	-8	-19	-14	-15	-15	-16	-30	-37	24	23	43 N.MI.	22
10,000	15	10	12	12	12	1	-5	-17	-11	-13	-13	-14	-25	-31	19	18	13	17
5,000	10	7	7	8	8	-2	-7	-11	-7	-8	-8	-8	-18	-23	16	16	12	14
FRESNO TO LOS ANGELES																		
15,000	12	8	0	3	5	-6	-12	-14	-10	0	-4	-6	-18	-25	21	18	182 N.MI.	16
10,000	9	8	-2	2	3	-5	-9	-10	-9	1	-2	-4	-13	-19	15	14	9	12
5,000	4	4	2	4	3	-3	-6	-4	-4	-2	-4	-3	-9	-13	10	9	7	9
FRESNO TO MERCED																		
15,000	-21	-16	-6	-9	-12	-24	-32	19	15	6	8	11	-1	-7	22	19	49 N.MI.	18
10,000	-13	-11	-2	-6	-7	-17	-23	13	10	2	5	7	-2	-7	16	15	9	13
5,000	-5	-5	-4	-4	-5	-11	-14	5	5	4	4	4	-2	-5	11	10	7	9
FRESNO TO OAKLAND																		
15,000	-22	-17	-8	-10	-13	-26	-33	21	16	8	9	13	1	-5	22	19	132 N.MI.	17
10,000	-14	-11	-4	-7	-8	-18	-23	14	11	4	7	8	-1	-5	16	15	9	13
5,000	-6	-5	-4	-4	-5	-11	-14	5	5	4	4	5	-1	-5	11	10	7	9
FRESNO TO SAN FRANCISCO																		
15,000	-22	-17	-9	-10	-14	-26	-33	21	16	8	10	13	2	-4	22	19	138 N.MI.	17
10,000	-14	-11	-4	-7	-8	-18	-23	14	11	4	7	8	-1	-5	16	15	9	13
5,000	-6	-5	-4	-4	-5	-11	-14	5	5	4	4	5	-1	-5	11	10	7	9

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT DIRECT								RETURN								STANDARD DEVIATION			
	JAN	APR	JUL	OCT	**A50	A75	A85		JAN	APR	JUL	OCT	A50	A75	A85		JAN	APR	JUL	OCT
FRESNO TO VISALIA																				
15,000	15	11	2	5	7	-4	-10		-17	-12	-2	-6	-8	-21	-28		22	19	12	18
10,000	10	9	-1	3	5	-4	-9		-11	-9	0	-4	-5	-15	-20		16	15	9	13
5,000	4	4	3	4	4	-2	-6		-4	-4	-3	-4	-4	-10	-13		11	10	7	9
GAINESVILLE TO JACKSONVILLE																				
15,000	18	14	4	8	10	0	-5		-20	-15	-4	-9	-11	-22	-29		17	17	9	15
10,000	14	10	4	5	8	-1	-5		-15	-10	-4	-6	-8	-17	-22		14	14	9	13
5,000	8	7	4	3	5	-2	-6		-9	-7	-4	-4	-6	-13	-17		12	12	9	11
GAINESVILLE TO OCALA																				
15,000	3	4	-2	0	1	-8	-13		-6	-6	2	-1	-2	-12	-17		17	16	9	15
10,000	0	2	-3	-1	-1	-9	-13		-1	-3	3	1	0	-8	-13		14	14	9	13
5,000	-5	-3	-3	-2	-3	-10	-14		5	2	3	2	3	-4	-8		12	12	8	11
GANDER TO ST. JOHNS																				
15,000	3	-1	7	6	4	-11	-19		-6	-1	-8	-8	-6	-20	-28		25	23	17	22
10,000	4	0	4	7	4	-8	-15		-6	-1	-5	-9	-5	-17	-24		20	19	15	18
5,000	5	0	3	5	3	-7	-13		-6	-1	-3	-6	-4	-15	-20		18	17	14	14
GANDER TO STEPHENVILLE																				
15,000	-32	-17	-22	-28	-25	-39	-47		31	16	22	26	23	9	2		23	22	16	21
10,000	-24	-13	-17	-21	-19	-30	-37		23	12	17	20	18	6	0		19	18	14	18
5,000	-14	-6	-12	-15	-12	-22	-28		14	6	12	14	11	1	-5		18	16	14	13
GRAND FORKS TO WINNIPEG																				
15,000	-10	-7	-3	-8	-7	-18	-25		7	6	2	6	5	-6	-12		18	18	14	18
10,000	-9	-6	-4	-6	-6	-15	-20		7	5	3	5	5	-4	-9		14	14	12	14
5,000	-5	-2	0	-4	-3	-12	-17		4	2	0	3	2	-7	-12		14	14	12	14
GRAND JUNCTION TO LAS VEGAS																				
15,000	-18	-15	-13	-10	-14	-24	-30		17	14	13	10	13	3	-2		19	16	11	15
10,000	-10	-8	-7	-7	-8	-15	-19		9	8	7	7	8	1	-3		13	10	9	10
5,000	-2	-3	-1	2	-1	-5	-8		2	3	1	-2	1	-4	-6		7	7	5	7
GRAND RAPIDS TO LAND O LAKES																				
15,000	-25	-17	-16	-17	-18	-31	-38		22	15	15	15	17	5	-2		20	20	13	19
10,000	-18	-12	-12	-13	-14	-24	-29		17	11	11	12	13	3	-3		15	16	12	15
5,000	-10	-7	-6	-7	-7	-16	-21		9	7	5	6	7	-2	-7		14	15	11	13
GRAND RAPIDS TO LANSING																				
15,000	37	24	20	23	25	12	5		-38	-25	-20	-24	-26	-40	-47		21	21	14	21
10,000	27	18	15	18	19	8	3		-27	-18	-15	-18	-19	-30	-36		16	17	13	16
5,000	15	9	8	10	10	1	-4		-15	-10	-8	-11	-11	-20	-25		15	16	11	13
GRAND RAPIDS TO MILWAUKEE																				
15,000	-37	-24	-20	-23	-25	-39	-46		36	23	19	22	24	12	5		21	21	14	20
10,000	-27	-18	-15	-18	-19	-30	-36		26	17	15	17	19	8	3		16	17	13	15
5,000	-15	-9	-8	-11	-11	-20	-25		14	9	8	10	10	1	-4		15	16	11	13
GRAND RAPIDS TO MUSKEGON																				
15,000	-32	-22	-18	-21	-22	-36	-44		30	21	17	19	21	8	2		21	21	14	21
10,000	-24	-16	-14	-16	-17	-28	-34		23	15	13	15	16	6	0		16	17	13	16
5,000	-13	-9	-7	-9	-9	-19	-24		12	8	7	8	9	0	-5		15	16	11	14
GRAND RAPIDS TO SAGINAW																				
15,000	30	18	16	19	20	8	1		-32	-20	-17	-20	-22	-35	-43		21	21	14	20
10,000	22	14	12	15	15	5	-1		-23	-15	-12	-16	-16	-27	-33		16	17	13	16
5,000	12	7	7	9	9	0	-5		-13	-7	-7	-10	-9	-19	-24		15	16	11	13
GREAT FALLS TO HELENA																				
15,000	-4	-5	-9	-6	-6	-17	-23		2	4	9	4	5	-6	-13		18	17	14	17
10,000	-4	-3	-5	-4	-4	-12	-16		2	3	4	3	3	-5	-9		13	12	10	12
5,000	-11	-4	-2	-5	-5	-13	-17		11	3	2	5	5	-3	-7		12	11	10	11
GREAT FALLS TO MISSOULA																				
15,000	-23	-15	-17	-19	-18	-29	-36		21	14	16	18	17	6	0		18	17	14	17
10,000	-17	-11	-9	-14	-12	-21	-25		17	10	9	13	12	4	0		13	12	10	12
5,000	-13	-6	-4	-7	-7	-15	-19		13	6	4	7	7	0	-4		12	11	9	11

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
GREAT FALLS TO SALT LAKE CITY																		
15,000	4	0	-5	1	0	-10	-16	-7	-1	4	-3	-1	-12	-18	17	16	12	16
10,000	3	0	-3	0	0	-7	-11	-4	-1	2	-1	-1	-8	-12	12	11	9	11
5,000	-9	-3	-2	-4	-4	-10	-14	8	3	2	4	4	-2	-5	10	9	7	9
GREAT FALLS TO SPOKANE																		
15,000	-26	-16	-16	-21	-19	-31	-37	25	16	16	20	19	8	2	18	17	13	17
10,000	-19	-12	-9	-15	-13	-22	-27	19	12	9	14	13	5	1	14	12	10	12
5,000	-11	-5	-4	-6	-7	-14	-18	11	5	4	6	6	-1	-4	12	10	9	11
GREENSBORO TO GREENVILLE																		
15,000	-36	-25	-9	-17	-20	-35	-43	35	24	9	16	19	7	1	19	19	11	19
10,000	-24	-18	-8	-13	-15	-26	-32	23	17	8	12	14	4	0	15	16	10	14
5,000	-13	-10	-5	-5	-8	-16	-21	12	9	5	4	7	-1	-5	14	13	9	12
GREENSBORO TO LOUISVILLE																		
15,000	-35	-27	-12	-18	-22	-36	-44	33	26	12	17	21	9	3	19	19	11	18
10,000	-26	-20	-10	-14	-17	-27	-33	25	19	10	13	16	7	2	15	16	11	14
5,000	-14	-11	-6	-7	-9	-17	-22	13	10	6	6	9	1	-3	14	13	9	12
GREENSBORO TO NEW YORK																		
15,000	31	19	12	18	19	7	1	-34	-21	-12	-20	-20	-34	-41	19	19	11	18
10,000	21	15	9	13	14	4	0	-23	-16	-9	-14	-15	-25	-31	15	16	11	14
5,000	11	8	5	6	7	-1	-5	-12	-8	-5	-6	-8	-16	-21	13	13	9	12
GREENSBORO TO PITTSBURGH																		
15,000	-2	-6	-1	2	-2	-13	-20	-3	3	0	-4	-1	-12	-19	20	20	12	19
10,000	-3	-4	-2	0	-2	-12	-17	0	3	2	-1	1	-8	-14	16	16	11	14
5,000	-1	-2	-2	-1	-1	-9	-14	0	2	1	0	1	-7	-12	14	13	9	12
GREENSBORO TO RALEIGH																		
15,000	36	29	11	17	21	9	3	-37	-30	-12	-18	-22	-37	-46	20	20	11	19
10,000	27	21	10	13	17	7	1	-28	-21	-10	-14	-17	-29	-35	16	16	11	15
5,000	15	11	6	6	9	1	-4	-15	-11	-7	-6	-9	-18	-23	14	13	9	13
GREENSBORO TO RICHMOND																		
15,000	35	23	11	18	20	8	2	-36	-25	-11	-19	-21	-36	-44	20	20	11	19
10,000	24	17	9	13	15	5	0	-25	-18	-9	-14	-16	-27	-33	16	16	11	15
5,000	12	9	5	6	8	0	-5	-13	-10	-5	-6	-8	-17	-22	14	13	9	13
GREENSBORO TO ROANOKE																		
15,000	2	-4	-1	2	0	-12	-18	-6	1	0	-4	-2	-14	-21	20	20	12	19
10,000	-2	-2	-1	1	-1	-11	-16	-1	1	1	-2	0	-10	-15	16	17	11	15
5,000	-1	-1	-1	0	-1	-9	-13	0	0	1	0	0	-8	-12	14	13	9	13
GREENSBORO TO WASHINGTON, D.C.																		
15,000	28	16	9	16	16	4	-2	-30	-19	-10	-17	-18	-31	-39	20	20	11	19
10,000	18	12	7	11	12	2	-3	-20	-14	-8	-12	-13	-23	-29	16	16	11	14
5,000	10	7	4	5	6	-2	-6	-10	-7	-4	-5	-6	-15	-20	14	13	9	12
GREENVILLE TO RICHMOND																		
15,000	35	23	10	17	20	8	2	-36	-25	-10	-18	-21	-35	-43	19	19	11	18
10,000	24	17	8	13	15	5	0	-25	-18	-9	-13	-15	-26	-32	15	16	10	14
5,000	12	9	5	5	8	0	-4	-13	-10	-5	-5	-8	-16	-21	13	13	9	12
GREENVILLE TO SPARTANBURG																		
15,000	37	28	9	17	21	8	2	-38	-29	-9	-18	-22	-37	-46	20	20	11	19
10,000	27	20	8	12	16	6	1	-27	-20	-8	-13	-16	-28	-34	15	16	11	15
5,000	14	11	6	5	8	0	-4	-15	-11	-6	-5	-9	-17	-22	14	13	9	13
GREENVILLE TO WINSTON-SALEM																		
15,000	34	23	8	16	18	6	0	-35	-24	-9	-17	-19	-34	-43	20	19	11	19
10,000	23	16	7	12	14	4	-1	-24	-17	-8	-12	-14	-25	-31	15	16	10	15
5,000	12	9	4	4	7	-1	-5	-13	-9	-5	-5	-7	-16	-21	14	13	9	12
HALIFAX TO MONCTON																		
15,000	-16	-12	-13	-12	-13	-27	-35	12	9	12	10	11	-3	-11	24	23	15	21
10,000	-13	-9	-11	-12	-11	-22	-29	11	8	10	11	10	-1	-7	19	18	13	17
5,000	-9	-6	-6	-7	-7	-17	-22	8	6	6	7	7	-3	-8	16	16	12	13

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**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	D I R E C T								R E T U R N													
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
HALIFAX TO ST. JOHN																			104 N.MI.			
15,000	-33	-23	-23	-26	-26	-40	-48	32	22	22	24	25	11	3	24	23	15	21				
10,000	-26	-17	-17	-20	-20	-31	-37	25	16	17	20	19	8	2	19	18	13	16				
5,000	-15	-11	-12	-12	-12	-22	-27	14	10	12	12	12	2	-3	16	16	12	13				
HALIFAX TO SYDNEY																			165 N.MI.			
15,000	33	21	20	26	24	11	3	-34	-22	-21	-27	-25	-40	-48	23	23	15	21				
10,000	24	15	15	18	18	7	1	-25	-16	-16	-19	-18	-30	-36	19	18	13	16				
5,000	12	9	12	11	11	1	-4	-13	-9	-13	-12	-12	-21	-26	16	16	12	13				
HARRISBURG TO PITTSBURGH																			155 N.MI.			
15,000	-43	-29	-19	-24	-27	-42	-51	42	28	18	23	26	14	7	21	21	13	20				
10,000	-31	-22	-15	-20	-21	-33	-39	30	22	15	19	21	10	5	17	17	12	15				
5,000	-16	-12	-9	-10	-11	-20	-25	16	12	8	10	11	3	-2	15	15	10	12				
HARRISBURG TO READING																			42 N.MI.			
15,000	41	27	18	24	26	13	6	-42	-28	-19	-25	-27	-42	-51	22	22	13	20				
10,000	29	21	14	19	20	9	4	-30	-22	-15	-19	-21	-32	-39	17	18	12	16				
5,000	15	11	8	10	11	2	-3	-16	-12	-8	-10	-11	-20	-26	15	15	10	13				
HARRISBURG TO WASHINGTON, D.C.																			82 N.MI.			
15,000	-9	-1	-2	-8	-5	-18	-25	4	-2	1	6	2	-10	-17	22	21	13	20				
10,000	-5	-1	0	-4	-2	-12	-18	2	-1	0	2	1	-9	-15	17	17	12	15				
5,000	-2	0	0	-1	-1	-9	-14	1	-1	0	1	0	-8	-13	15	15	10	13				
HARRISBURG TO WILLIAMSPORT																			61 N.MI.			
15,000	-2	-6	-2	1	-2	-15	-22	-3	3	1	-4	0	-13	-21	22	22	13	20				
10,000	-3	-5	-3	-1	-3	-13	-19	0	3	2	-1	1	-9	-15	17	18	12	15				
5,000	-1	-3	-2	-1	-2	-10	-15	0	2	1	0	1	-8	-13	15	15	10	13				
HARTFORD TO NEW HAVEN																			30 N.MI.			
15,000	-21	-10	-8	-13	-12	-26	-34	17	7	6	11	10	-3	-10	23	22	14	21				
10,000	-12	-7	-5	-9	-8	-19	-25	9	5	4	8	6	-4	-10	18	18	12	16				
5,000	-6	-3	-3	-4	-4	-13	-18	4	2	3	4	3	-6	-11	16	15	11	13				
HARTFORD TO NEW YORK																			84 N.MI.			
15,000	-30	-18	-13	-19	-19	-33	-41	27	15	12	17	17	4	-3	22	22	13	20				
10,000	-20	-13	-9	-13	-13	-24	-30	18	11	8	12	12	2	-4	18	18	12	15				
5,000	-10	-6	-6	-7	-7	-16	-21	9	5	5	6	6	-3	-8	15	15	11	13				
HARTFORD TO PHILADELPHIA																			161 N.MI.			
15,000	-34	-21	-15	-21	-22	-36	-44	32	19	14	20	20	7	1	22	21	13	20				
10,000	-23	-16	-11	-15	-16	-27	-33	21	14	10	14	15	4	-1	17	18	12	15				
5,000	-12	-8	-7	-8	-8	-17	-22	11	7	6	7	8	-1	-6	15	15	11	13				
HARTFORD TO PITTSBURGH																			350 N.MI.			
15,000	-42	-28	-19	-25	-27	-41	-49	40	26	19	24	26	14	8	21	20	12	19				
10,000	-30	-21	-15	-19	-20	-31	-37	29	20	14	19	20	10	5	16	17	11	14				
5,000	-16	-11	-9	-10	-11	-20	-25	15	11	9	10	11	3	-2	14	14	10	12				
HARTFORD TO PITTSFIELD																			51 N.MI.			
15,000	-20	-18	-13	-12	-15	-29	-36	16	16	12	10	13	0	-7	23	22	14	21				
10,000	-18	-14	-11	-10	-13	-24	-30	16	13	10	9	12	1	-5	18	18	12	16				
5,000	-10	-9	-6	-6	-8	-17	-22	9	8	6	6	7	-2	-7	16	15	11	13				
HARTFORD TO PROVIDENCE																			54 N.MI.			
15,000	39	28	20	24	27	14	7	-40	-29	-21	-25	-28	-42	-50	23	22	14	21				
10,000	30	21	16	19	21	10	4	-30	-22	-16	-19	-21	-33	-39	18	18	12	16				
5,000	15	12	10	10	12	3	-2	-16	-12	-10	-11	-12	-22	-27	16	15	11	13				
HARTFORD TO WASHINGTON, D.C.																			265 N.MI.			
15,000	-35	-22	-15	-22	-22	-36	-44	33	20	14	20	21	8	2	21	21	12	19				
10,000	-24	-17	-11	-16	-16	-27	-33	22	15	10	15	15	5	0	17	17	11	15				
5,000	-12	-8	-7	-8	-9	-17	-22	12	8	6	7	8	0	-5	14	14	10	12				
HELENA TO MISSOULA																			88 N.MI.			
15,000	-27	-16	-16	-21	-20	-31	-38	26	16	15	20	19	8	2	19	18	14	17				
10,000	-20	-12	-9	-15	-13	-22	-27	19	11	9	15	13	5	0	14	12	10	12				
5,000	-10	-5	-5	-6	-6	-14	-18	10	5	4	5	6	-1	-5	12	11	9	11				

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*												STANDARD DEVIATION			
	D I R E C T							R E T U R N					JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85		
HOBBS TO MIDLAND, TEX.																
15,000	19	15	0	8	9	-2	-7	-20	-16	0	-9	-10	-22	-30	19	71 N.MI.
10,000	11	8	0	4	5	-3	-7	-12	-8	0	-4	-6	-15	-20	14	16
5,000	0	-2	-5	-3	-3	-10	-14	0	1	5	3	3	-5	-9	12	12
HOBBS TO ROSWELL																
15,000	-24	-19	-2	-11	-13	-26	-33	23	18	2	10	12	1	-4	19	78 N.MI.
10,000	-15	-11	-2	-6	-8	-17	-22	15	10	2	5	7	-1	-5	14	11
5,000	-1	0	3	3	1	-6	-10	1	0	-3	-3	-2	-8	-12	12	16
HOT SPRINGS TO LITTLE ROCK																
15,000	34	24	7	15	18	6	0	-35	-25	-7	-15	-19	-34	-43	20	45 N.MI.
10,000	24	17	6	10	14	4	-1	-25	-18	-6	-11	-14	-25	-31	15	18
5,000	12	10	7	5	8	0	-5	-12	-10	-7	-5	-9	-17	-22	14	14
HOT SPRINGS TO SHREVEPORT																
15,000	-15	-9	-2	-4	-7	-18	-25	12	7	2	3	5	-5	-11	19	127 N.MI.
10,000	-11	-7	-4	-3	-6	-15	-20	9	6	4	2	5	-4	-8	14	11
5,000	-7	-6	-6	-3	-6	-14	-18	6	6	6	2	5	-3	-8	14	17
HOULTON TO PRESQUE ISLE																
15,000	-6	-6	-8	-5	-7	-20	-28	2	4	7	3	4	-9	-17	23	36 N.MI.
10,000	-8	-6	-8	-6	-7	-18	-24	6	5	7	5	6	-5	-11	18	22
5,000	-7	-4	-4	-4	-4	-14	-19	6	3	3	3	4	-6	-11	16	17
HOUSTON TO LAKE CHARLES																
15,000	29	23	4	10	15	4	-2	-30	-24	-4	-11	-16	-29	-36	17	114 N.MI.
10,000	20	15	3	6	10	1	-3	-20	-15	-3	-6	-10	-20	-26	13	16
5,000	10	7	4	4	6	-1	-5	-11	-8	-5	-4	-7	-15	-19	13	13
HOUSTON TO NEW ORLEANS																
15,000	29	23	4	11	15	4	-1	-30	-24	-4	-12	-16	-29	-36	16	262 N.MI.
10,000	19	14	2	6	10	1	-3	-20	-15	-2	-7	-10	-20	-25	13	10
5,000	9	7	3	4	5	-2	-6	-10	-7	-3	-4	-6	-13	-18	13	12
HOUSTON TO SAN ANTONIO																
15,000	-29	-24	-3	-10	-15	-28	-36	28	23	2	10	15	3	-2	17	167 N.MI.
10,000	-19	-14	-2	-6	-10	-19	-24	18	14	2	6	9	1	-4	13	15
5,000	-9	-6	-2	-3	-4	-12	-17	9	5	2	3	4	-3	-7	13	12
HOUSTON TO SHREVEPORT																
15,000	16	10	3	4	7	-2	-8	-18	-12	-3	-5	-9	-20	-26	17	184 N.MI.
10,000	12	9	4	3	7	-2	-6	-13	-10	-5	-3	-7	-16	-21	13	16
5,000	8	8	7	4	7	-1	-5	-9	-8	-7	-4	-7	-15	-19	13	13
HOUSTON TO TULSA																
15,000	0	-2	0	-2	-1	-11	-16	-3	0	-1	1	-1	-10	-16	17	394 N.MI.
10,000	1	1	2	-1	1	-7	-12	-2	-2	-2	0	-2	-9	-14	13	16
5,000	3	4	6	2	4	-4	-8	-4	-4	-6	-2	-4	-12	-16	13	12
HUNTINGTON TO LEXINGTON																
15,000	-41	-28	-15	-22	-24	-39	-48	40	26	14	21	24	11	5	21	99 N.MI.
10,000	-29	-20	-12	-16	-19	-30	-36	28	20	12	16	18	8	3	16	20
5,000	-15	-11	-7	-8	-10	-19	-24	15	11	7	8	10	1	-3	15	15
HUNTINGTON TO LOUISVILLE																
15,000	-41	-28	-15	-22	-25	-39	-48	40	27	14	21	24	11	5	20	150 N.MI.
10,000	-29	-21	-12	-17	-19	-30	-36	29	20	12	16	19	8	3	15	12
5,000	-15	-11	-7	-8	-10	-19	-24	15	11	7	8	10	1	-3	14	19
HUNTSVILLE TO KNOXVILLE																
15,000	36	24	8	16	19	7	1	-37	-26	-8	-17	-20	-35	-44	20	144 N.MI.
10,000	25	17	7	11	14	5	0	-26	-18	-8	-12	-15	-26	-32	15	19
5,000	13	10	5	4	8	0	-5	-14	-10	-5	-5	-8	-17	-22	14	14
HUNTSVILLE TO LEXINGTON																
15,000	19	10	5	8	10	-2	-7	-23	-13	-5	-10	-11	-24	-32	19	223 N.MI.
10,000	13	8	4	6	7	-2	-7	-15	-9	-5	-7	-8	-18	-24	15	11
5,000	7	5	3	3	4	-4	-8	-8	-6	-3	-3	-5	-13	-17	14	19

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*							STANDARD DEVIATION						
	DIRECT								RETURN							JAN	APR	JUL	OCT			
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
HUNTSVILLE TO LOUISVILLE																			214 N.MI.			
15,000	10	3	2	4	4	-7	-13	-14	-6	-2	-5	-6	-18	-25	20	19	11	19				
10,000	6	3	2	3	3	-6	-11	-9	-4	-3	-4	-5	-14	-19	15	15	11	14				
5,000	3	2	1	1	2	-6	-11	-4	-3	-2	-1	-2	-11	-15	14	14	9	12				
HUNTSVILLE TO MEMPHIS																			169 N.MI.			
15,000	-37	-28	-8	-17	-20	-36	-44	35	27	8	16	20	7	1	20	19	11	18				
10,000	-26	-19	-7	-12	-15	-26	-32	26	19	7	12	15	5	0	14	15	10	14				
5,000	-14	-11	-6	-5	-8	-17	-22	13	10	6	5	8	0	-5	14	14	9	12				
HUNTSVILLE TO NASHVILLE																			87 N.MI.			
15,000	2	-3	-1	-1	-1	-12	-18	-6	0	0	-1	-1	-13	-19	20	20	11	19				
10,000	0	-2	0	0	0	-10	-15	-2	0	-1	0	-1	-10	-15	15	16	11	15				
5,000	0	0	0	-1	0	-8	-13	-1	-1	0	0	-1	-9	-13	14	14	10	13				
HUNTSVILLE TO WASHINGTON, D.C.																			522 N.MI.			
15,000	36	24	11	18	21	9	4	-38	-25	-11	-19	-22	-36	-44	18	18	10	17				
10,000	25	17	9	14	16	6	2	-26	-18	-10	-14	-16	-26	-32	14	15	10	13				
5,000	13	10	6	6	8	1	-3	-14	-10	-6	-6	-8	-16	-21	13	12	9	11				
HURON TO PIERRE																			88 N.MI.			
15,000	-28	-19	-20	-26	-23	-35	-42	28	18	19	25	22	11	4	19	20	13	18				
10,000	-21	-12	-14	-15	-15	-25	-30	21	12	13	15	15	5	0	15	15	12	15				
5,000	-11	-6	-5	-9	-8	-17	-22	11	5	5	9	8	-2	-7	13	14	12	14				
HURON TO SIOUX FALLS																			80 N.MI.			
15,000	26	18	16	21	20	8	2	-27	-19	-16	-23	-21	-33	-40	20	20	13	19				
10,000	21	13	12	15	15	5	0	-21	-14	-12	-15	-15	-25	-31	15	15	12	15				
5,000	12	6	4	9	8	-1	-6	-12	-7	-5	-10	-8	-18	-23	14	14	12	14				
HYANNIS TO NANTUCKET																			26 N.MI.			
15,000	6	10	7	4	7	-6	-14	-11	-13	-9	-6	-9	-23	-30	23	22	14	21				
10,000	10	9	7	4	7	-3	-9	-13	-10	-7	-6	-9	-20	-26	18	18	12	16				
5,000	6	6	4	4	5	-4	-9	-7	-7	-4	-4	-6	-15	-20	16	16	11	13				
IDAHO FALLS TO POCATELLO																			43 N.MI.			
15,000	-9	-8	-12	-8	-9	-21	-27	7	7	11	7	8	-3	-10	19	18	13	17				
10,000	-6	-5	-7	-6	-6	-14	-18	5	5	6	6	5	-2	-7	13	12	10	12				
5,000	-10	-5	-4	-6	-6	-12	-16	10	5	4	5	6	0	-3	10	9	7	9				
IDAHO FALLS TO SALT LAKE CITY																			164 N.MI.			
15,000	5	1	-4	2	1	-10	-16	-7	-2	3	-3	-2	-13	-20	19	17	12	17				
10,000	3	1	-3	1	0	-7	-11	-4	-1	3	-1	-1	-9	-13	13	11	10	11				
5,000	-9	-5	-4	-5	-5	-11	-14	8	4	4	5	5	0	-3	9	8	7	8				
INDIANAPOLIS TO LOUISVILLE																			96 N.MI.			
15,000	7	7	4	5	6	-6	-13	-11	-10	-5	-7	-8	-20	-27	20	21	13	20				
10,000	6	6	3	4	5	-5	-11	-8	-7	-4	-5	-6	-16	-21	16	17	12	15				
5,000	3	3	1	2	2	-6	-11	-4	-4	-2	-3	-3	-12	-16	15	15	10	13				
INDIANAPOLIS TO MEMPHIS																			331 N.MI.			
15,000	-25	-15	-7	-11	-13	-26	-33	22	13	6	9	12	0	-5	19	19	11	18				
10,000	-17	-11	-6	-8	-10	-20	-25	16	10	6	7	9	0	-5	14	15	11	14				
5,000	-9	-7	-4	-4	-6	-14	-19	8	6	4	4	5	-3	-7	14	14	9	12				
INDIANAPOLIS TO NASHVILLE																			217 N.MI.			
15,000	-8	-3	-2	-3	-3	-15	-22	4	0	1	1	1	-10	-16	20	20	12	19				
10,000	-5	-2	-1	-2	-2	-12	-17	3	0	1	1	1	-8	-13	15	16	11	15				
5,000	-2	-1	-1	-1	-1	-10	-14	2	1	1	0	1	-7	-12	14	14	10	12				
INDIANAPOLIS TO PITTSBURGH																			282 N.MI.			
15,000	41	26	17	23	25	13	7	-42	-27	-18	-24	-26	-41	-49	20	20	12	19				
10,000	29	20	14	18	20	10	4	-30	-21	-14	-19	-20	-31	-37	15	16	11	15				
5,000	15	11	7	10	10	2	-2	-16	-11	-8	-10	-11	-20	-24	14	14	10	12				
INDIANAPOLIS TO ST. LOUIS																			199 N.MI.			
15,000	-38	-25	-15	-21	-23	-38	-46	37	24	15	19	23	10	4	20	20	12	19				
10,000	-28	-19	-12	-16	-18	-29	-35	27	19	12	15	18	7	2	15	16	12	15				
5,000	-15	-10	-7	-9	-10	-19	-24	14	10	7	9	9	1	-4	15	15	10	13				

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
INDIANAPOLIS TO TERRE HAUTE																		
15,000	-38	-25	-16	-21	-24	-39	-47	37	24	15	20	23	10	3	21	21	13	20
10,000	-28	-19	-12	-16	-18	-30	-35	27	19	12	16	18	7	2	16	17	12	15
5,000	-15	-10	-7	-9	-10	-19	-24	14	10	7	9	9	1	-4	15	15	10	13
JACKSON TO MEMPHIS																		
15,000	7	1	-1	1	1	-9	-15	-11	-3	0	-2	-3	-15	-21	19	18	11	18
10,000	5	2	3	0	2	-6	-11	-7	-3	-3	-1	-3	-12	-17	14	15	10	14
5,000	4	3	2	0	2	-6	-10	-5	-4	-2	-1	-3	-11	-16	14	14	9	12
JACKSON TO MERIDIAN																		
15,000	33	25	6	14	18	5	0	-34	-26	-6	-15	-18	-33	-41	18	18	11	17
10,000	23	17	4	9	12	3	-2	-23	-17	-5	-10	-13	-24	-30	14	15	10	14
5,000	11	9	4	4	7	-1	-6	-12	-9	-4	-5	-7	-16	-20	14	13	9	12
JACKSON TO MONROE																		
15,000	-33	-26	-6	-14	-18	-32	-40	32	25	6	14	17	5	0	18	18	11	17
10,000	-22	-17	-4	-9	-12	-23	-29	22	16	4	9	12	2	-3	14	14	10	14
5,000	-11	-8	-4	-5	-7	-15	-20	11	8	4	4	6	-2	-6	14	14	9	12
JACKSON TO NEW ORLEANS																		
15,000	-7	-1	2	-1	-1	-12	-18	4	-1	-2	0	0	-10	-15	17	17	10	16
10,000	-5	-3	-4	1	-3	-11	-16	3	2	3	-1	2	-7	-11	14	14	10	13
5,000	-5	-4	-3	0	-3	-11	-15	5	4	3	0	3	-5	-9	13	13	9	12
JACKSON TO SHREVEPORT																		
15,000	-33	-26	-6	-14	-18	-32	-40	32	25	6	14	17	5	0	18	17	11	17
10,000	-23	-17	-4	-9	-12	-23	-29	22	16	4	9	12	3	-2	14	14	10	13
5,000	-11	-8	-5	-5	-7	-15	-20	11	8	5	4	7	-1	-6	14	13	9	12
JACKSONVILLE TO MACON																		
15,000	-18	-16	-2	-7	-10	-22	-29	16	15	2	6	9	-1	-7	17	17	10	16
10,000	-11	-10	-1	-4	-6	-15	-20	10	9	0	4	5	-3	-8	14	14	9	13
5,000	-2	-3	-1	-2	-2	-9	-14	2	3	1	1	2	-6	-10	13	12	9	11
JACKSONVILLE TO MELBOURNE																		
15,000	8	8	-2	1	3	-6	-11	-10	-9	2	-2	-4	-14	-20	16	16	9	14
10,000	3	4	-3	-1	1	-7	-11	-4	-5	2	0	-1	-9	-14	13	13	9	12
5,000	-5	-1	-2	-2	-3	-9	-13	4	1	2	1	2	-5	-9	12	11	8	11
JACKSONVILLE TO MIAMI																		
15,000	6	6	-3	0	1	-7	-11	-7	-7	3	0	-2	-11	-17	15	14	8	13
10,000	1	2	-4	-2	-1	-8	-12	-1	-3	4	2	1	-7	-11	12	12	8	11
5,000	-6	-3	-4	-3	-4	-10	-14	6	3	4	3	4	-3	-6	11	11	7	10
JACKSONVILLE TO ORLANDO																		
15,000	2	3	-2	-1	0	-9	-14	-5	-4	2	0	-1	-11	-16	16	16	9	14
10,000	-1	1	-3	-2	-1	-9	-14	0	-2	3	1	1	-7	-12	14	13	9	12
5,000	-6	-3	-3	-2	-3	-10	-14	5	2	3	2	3	-4	-8	12	12	8	11
JACKSONVILLE TO SARASOTA																		
15,000	-8	-6	-4	-5	-5	-14	-19	6	4	4	4	4	-4	-9	16	15	9	14
10,000	-7	-5	-4	-4	-5	-13	-17	7	4	4	4	5	-3	-7	13	13	9	12
5,000	-8	-6	-4	-4	-5	-12	-16	8	5	4	4	5	-2	-6	12	11	8	11
JACKSONVILLE TO SAVANNAH																		
15,000	9	6	3	5	5	-4	-10	-11	-8	-3	-6	-6	-17	-23	17	17	10	16
10,000	8	4	4	4	5	-4	-8	-9	-5	-4	-4	-5	-14	-19	14	14	9	13
5,000	7	4	3	2	4	-3	-7	-7	-5	-3	-3	-4	-12	-16	12	12	9	11
JACKSONVILLE TO TALLAHASSEE																		
15,000	-30	-25	-4	-13	-16	-30	-37	30	24	4	12	16	4	-1	17	17	9	15
10,000	-20	-16	-3	-8	-11	-21	-27	20	16	3	7	11	1	-3	14	14	9	13
5,000	-8	-8	-3	-4	-6	-13	-17	8	8	3	4	5	-2	-6	12	12	8	11
JACKSONVILLE TO TAMPA																		
15,000	-10	-7	-4	-6	-6	-15	-21	8	6	3	5	5	-4	-9	16	16	9	14
10,000	-9	-5	-4	-4	-5	-13	-18	8	5	4	4	5	-3	-7	13	13	9	12
5,000	-8	-6	-4	-4	-5	-12	-16	8	5	4	3	5	-2	-6	12	11	8	11

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	DIRECT							RETURN							JAN	APR	JUL	OCT				
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
JACKSONVILLE TO WAYCROSS																			64 N.MI.			
15,000	-19	-16	-2	-7	-9	-21	-29	17	15	1	6	8	-2	-7	17	17	10	16				
10,000	-11	-10	0	-4	-6	-15	-20	10	9	0	3	5	-4	-8	14	14	9	13				
5,000	-1	-3	0	-1	-1	-9	-13	1	3	0	1	1	-6	-10	12	12	9	12				
JACKSONVILLE TO WEST PALM BEACH																			238 N.MI.			
15,000	8	7	-3	1	2	-6	-10	-10	-9	2	-1	-3	-13	-19	15	15	8	13				
10,000	2	4	-3	-1	0	-8	-11	-3	-5	3	1	0	-8	-13	13	12	8	11				
5,000	-5	-2	-3	-3	-3	-10	-14	5	2	3	2	3	-4	-7	11	11	8	10				
JOPLIN TO SPRINGFIELD, MO.																			54 N.MI.			
15,000	34	24	11	18	20	8	2	-35	-25	-12	-18	-21	-35	-44	20	20	12	19				
10,000	24	17	9	13	15	5	0	-25	-18	-9	-13	-16	-26	-32	15	15	11	15				
5,000	12	9	7	7	9	0	-5	-12	-10	-7	-7	-9	-18	-23	14	15	10	13				
JOPLIN TO TULSA																			88 N.MI.			
15,000	-27	-20	-8	-13	-16	-29	-37	25	18	8	11	14	3	-3	20	19	12	18				
10,000	-19	-14	-7	-9	-12	-22	-27	18	13	6	9	11	2	-3	15	15	11	14				
5,000	-9	-9	-8	-6	-8	-17	-21	9	8	8	6	8	-1	-6	14	15	10	13				
KANSAS CITY TO MINNEAPOLIS																			351 N.MI.			
15,000	0	1	2	-1	1	-11	-17	-4	-3	-3	-1	-3	-14	-20	19	19	12	18				
10,000	0	0	1	-1	0	-9	-14	-2	-1	-2	0	-1	-10	-15	14	15	11	14				
5,000	-1	0	2	0	1	-8	-13	0	-1	-3	-1	-1	-9	-14	13	14	11	13				
KANSAS CITY TO OMAHA																			144 N.MI.			
15,000	-26	-16	-12	-17	-17	-30	-37	24	15	11	16	16	4	-2	20	20	13	19				
10,000	-18	-13	-8	-13	-13	-23	-28	17	12	8	12	12	2	-3	15	15	12	15				
5,000	-9	-6	-3	-7	-6	-15	-20	9	5	2	7	6	-3	-8	14	14	11	13				
KANSAS CITY TO ST. LOUIS																			199 N.MI.			
15,000	35	24	15	20	22	10	4	-36	-25	-15	-21	-23	-37	-44	20	20	12	19				
10,000	26	18	11	14	17	7	2	-26	-19	-11	-15	-17	-28	-33	15	15	11	15				
5,000	13	9	6	9	9	0	-4	-13	-10	-7	-9	-9	-18	-23	14	14	10	13				
KANSAS CITY TO SPRINGFIELD, MO.																			126 N.MI.			
15,000	14	10	6	10	10	-2	-8	-18	-12	-6	-12	-11	-24	-31	20	20	12	19				
10,000	11	8	4	7	7	-2	-7	-12	-9	-4	-8	-8	-18	-23	15	15	11	15				
5,000	5	3	1	3	3	-6	-10	-6	-3	-1	-4	-3	-12	-17	14	15	10	13				
KANSAS CITY TO TULSA																			185 N.MI.			
15,000	-12	-9	-4	-4	-7	-19	-25	9	7	4	3	5	-6	-12	20	19	12	18				
10,000	-8	-6	-4	-3	-5	-14	-20	7	5	3	3	4	-5	-10	14	15	11	14				
5,000	-4	-5	-6	-3	-5	-13	-18	4	4	5	3	4	-4	-9	14	14	10	12				
KANSAS CITY TO WICHITA																			154 N.MI.			
15,000	-27	-20	-11	-14	-17	-30	-37	25	19	11	13	16	5	-2	20	19	12	18				
10,000	-19	-14	-8	-10	-12	-22	-28	18	13	8	9	12	2	-3	15	15	11	14				
5,000	-9	-8	-8	-7	-8	-16	-21	8	8	7	7	8	-1	-6	14	14	10	12				
KEENE TO NEW YORK																			152 N.MI.			
15,000	-24	-13	-9	-15	-15	-28	-36	20	10	8	14	12	0	-7	22	21	14	20				
10,000	-14	-9	-6	-10	-10	-20	-26	12	7	5	9	8	-2	-8	17	18	12	15				
5,000	-7	-4	-4	-5	-5	-14	-19	6	3	4	5	4	-5	-9	15	15	11	13				
KEENE TO PITTSFIELD																			54 N.MI.			
15,000	-36	-23	-18	-24	-24	-39	-47	35	22	17	23	23	10	3	23	22	14	21				
10,000	-26	-17	-13	-17	-18	-29	-35	24	15	12	17	17	6	0	18	18	12	16				
5,000	-13	-9	-9	-10	-10	-19	-25	12	8	8	9	9	0	-5	16	15	11	13				
KEY WEST TO MIAMI																			109 N.MI.			
15,000	9	9	0	5	5	-2	-6	-9	-10	0	-5	-5	-14	-19	14	13	8	11				
10,000	5	5	0	4	3	-3	-7	-5	-6	0	-4	-3	-10	-14	12	10	7	10				
5,000	-1	4	1	0	1	-5	-9	0	-4	-1	0	-1	-7	-11	11	10	7	10				
KNOXVILLE TO LEXINGTON																			136 N.MI.			
15,000	-7	-8	-3	-4	-5	-17	-24	2	6	2	2	3	-8	-15	20	20	12	19				
10,000	-6	-6	-2	-3	-4	-14	-19	4	4	2	2	3	-6	-12	15	16	11	15				
5,000	-3	-3	-2	-2	-2	-10	-15	2	2	1	1	2	-7	-11	14	14	9	12				

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	O I R E C T							R E T U R N							JAN	APR	JUL	OCT				
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
KNOXVILLE TO LOUISVILLE																			165 N.MI.			
15,000	-18	-16	-7	-10	-12	-24	-31	14	14	6	8	10	-1	-7	20	20	12	19				
10,000	-14	-12	-5	-7	-9	-19	-25	12	10	5	6	8	-1	-6	15	16	11	15				
5,000	-7	-6	-4	-4	-5	-13	-18	6	5	3	3	4	-4	-8	14	14	9	12				
KNOXVILLE TO MEMPHIS																			297 N.MI.			
15,000	-39	-28	-9	-18	-22	-37	-45	38	27	9	17	21	8	3	19	19	11	18				
10,000	-28	-20	-8	-13	-16	-27	-33	27	19	8	12	16	6	1	14	15	10	14				
5,000	-15	-11	-6	-6	-9	-18	-22	14	11	6	5	9	1	-4	14	13	9	12				
KNOXVILLE TO NASHVILLE																			132 N.MI.			
15,000	-38	-28	-11	-19	-22	-37	-46	36	27	10	18	21	9	3	20	20	11	19				
10,000	-27	-20	-9	-13	-17	-28	-34	27	20	9	13	16	6	1	15	16	11	15				
5,000	-15	-11	-6	-6	-9	-18	-23	14	11	6	6	9	0	-4	14	14	9	12				
KNOXVILLE TO PITTSBURG																			332 N.MI.			
15,000	22	12	8	13	13	2	-4	-26	-14	-8	-15	-15	-28	-35	19	19	11	18				
10,000	15	9	5	9	9	0	-5	-17	-10	-6	-10	-10	-20	-26	15	16	11	14				
5,000	8	5	3	4	5	-3	-7	-9	-6	-3	-5	-5	-14	-18	14	13	9	12				
KNOXVILLE TO WASHINGTON, D.C.																			378 N.MI.			
15,000	36	24	12	19	21	9	4	-38	-25	-12	-20	-22	-36	-45	19	19	11	18				
10,000	25	18	10	14	16	7	2	-26	-19	-10	-15	-17	-27	-33	15	15	10	14				
5,000	13	10	6	6	8	1	-4	-14	-10	-6	-7	-9	-17	-22	13	13	9	12				
LAFAYETTE TO LAKE CHARLES																			60 N.MI.			
15,000	-30	-24	-4	-12	-16	-30	-37	29	24	4	11	16	4	-2	17	17	11	16				
10,000	-20	-15	-2	-7	-10	-21	-26	20	15	2	7	10	1	-4	14	14	10	13				
5,000	-10	-7	-3	-4	-6	-14	-18	9	6	3	4	5	-2	-7	14	13	9	12				
LAFAYETTE TO NEW ORLEANS																			92 N.MI.			
15,000	28	23	4	11	15	4	-2	-29	-24	-4	-12	-16	-29	-37	17	17	10	16				
10,000	19	14	2	7	9	0	-4	-19	-15	-2	-7	-10	-20	-26	14	14	10	13				
5,000	8	6	2	4	5	-3	-7	-9	-6	-2	-4	-5	-13	-18	13	13	9	12				
LAKELAND TO TAMPA																			27 N.MI.			
15,000	-23	-20	-2	-9	-12	-24	-31	23	20	2	9	12	2	-3	16	15	9	14				
10,000	-14	-12	-1	-5	-7	-16	-21	13	12	1	5	7	-1	-5	13	13	8	12				
5,000	-2	-5	-1	-2	-3	-10	-14	2	5	1	2	2	-5	-8	12	11	8	11				
LANCASTER TO READING																			22 N.MI.			
15,000	30	17	13	19	19	6	-1	-33	-19	-13	-20	-20	-35	-43	22	22	13	21				
10,000	20	13	9	14	14	3	-3	-22	-15	-10	-15	-15	-26	-32	18	18	12	16				
5,000	11	7	5	7	7	-2	-7	-11	-7	-6	-7	-8	-17	-22	15	15	10	13				
LANCASTER TO WASHINGTON																			83 N.MI.			
15,000	-22	-11	-8	-14	-13	-26	-34	18	8	7	13	11	-2	-8	22	21	13	20				
10,000	-14	-8	-5	-9	-9	-19	-25	11	6	4	8	7	-3	-8	17	17	12	15				
5,000	-7	-4	-3	-4	-4	-13	-18	6	3	2	4	4	-5	-10	15	15	10	13				
LAS VEGAS TO LOS ANGELES																			205 N.MI.			
15,000	-14	-13	-10	-8	-11	-22	-28	13	12	10	7	10	0	-6	20	17	11	16				
10,000	-7	-6	-6	-5	-6	-14	-18	6	5	5	5	5	-2	-7	15	13	9	12				
5,000	-4	-3	-4	4	-2	-8	-11	4	3	4	-5	2	-4	-8	9	9	6	8				
LAS VEGAS TO PALM SPRINGS																			150 N.MI.			
15,000	-6	-7	-8	-5	-7	-17	-23	4	6	8	4	6	-5	-11	20	18	11	16				
10,000	-1	-2	-5	-3	-3	-11	-15	1	1	5	3	3	-5	-10	15	13	9	12				
5,000	-3	-3	-4	4	-2	-7	-10	3	2	4	-4	1	-4	-8	9	8	6	8				
LAS VEGAS TO PHOENIX																			222 N.MI.			
15,000	17	13	1	7	8	-2	-7	-18	-14	-2	-7	-9	-21	-28	19	17	11	16				
10,000	11	8	1	4	5	-2	-6	-12	-9	-1	-4	-6	-14	-19	14	12	9	11				
5,000	-1	0	-2	-3	-2	-6	-9	0	0	2	3	1	-3	-6	8	8	6	7				
LAS VEGAS TO SACRAMENTO																			336 N.MI.			
15,000	-22	-17	-8	-10	-13	-25	-32	21	16	8	10	12	2	-4	20	18	11	16				
10,000	-14	-11	-3	-7	-8	-17	-22	13	10	3	6	8	0	-5	15	13	9	12				
5,000	-4	-4	-3	0	-3	-8	-12	4	4	3	0	3	-3	-6	10	8	6	8				

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION				
	DIRECT							RETURN							JAN	APR	JUL	OCT	
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85					
LAS VEGAS TO SALT LAKE CITY																			320 N.MI.
15,000	6	6	10	4	7	-4	-10	-8	-8	-10	-5	-8	-18	-24	19	17	11	16	
10,000	3	3	6	4	4	-3	-7	-4	-4	-6	-4	-5	-12	-16	13	11	9	11	
5,000	4	4	2	2	3	-1	-4	-4	-5	-2	-2	-3	-8	-11	8	7	5	7	
LAS VEGAS TO SAN FRANCISCO																			359 N.MI.
15,000	-22	-18	-9	-11	-14	-26	-32	21	17	9	10	13	3	-3	20	17	11	16	
10,000	-14	-11	-4	-7	-8	-17	-22	13	11	4	7	8	0	-4	15	13	9	12	
5,000	-5	-5	-4	0	-3	-9	-12	5	5	3	0	3	-2	-6	10	9	7	8	
LAWRENCE TO MANCHESTER																			19 N.MI.
15,000	-25	-21	-16	-16	-19	-33	-40	21	19	15	14	17	4	-3	23	22	15	21	
10,000	-22	-16	-13	-13	-16	-27	-33	20	15	13	12	15	4	-2	18	18	12	16	
5,000	-12	-10	-8	-8	-9	-19	-24	12	9	8	8	9	0	-5	16	16	12	13	
LAWRENCE TO WORCESTER																			42 N.MI.
15,000	-34	-22	-17	-23	-23	-37	-45	32	20	16	21	21	8	1	23	22	14	21	
10,000	-23	-15	-12	-16	-16	-28	-34	22	14	11	15	15	4	-1	18	18	12	16	
5,000	-12	-8	-8	-9	-9	-18	-24	11	7	8	8	9	-1	-6	16	15	11	13	
LAWTON TO OKLAHOMA CITY																			63 N.MI.
15,000	20	15	4	7	10	-1	-6	-22	-16	-5	-8	-11	-24	-32	20	18	11	17	
10,000	14	11	4	6	8	-1	-5	-15	-12	-4	-7	-9	-19	-24	15	14	10	14	
5,000	7	7	10	5	7	-1	-6	-8	-8	-10	-5	-8	-17	-21	14	15	10	13	
LAWTON TO WICHITA FALLS																			35 N.MI.
15,000	-8	-5	-2	-1	-4	-15	-21	5	3	2	0	2	-9	-15	19	18	11	17	
10,000	-5	-6	-2	-2	-4	-12	-17	4	5	2	1	3	-6	-11	15	14	10	13	
5,000	-5	-6	-9	-4	-6	-14	-19	4	5	8	3	5	-3	-8	14	14	10	13	
LEBANON TO MANCHESTER																			57 N.MI.
15,000	20	18	15	13	16	3	-4	-23	-19	-16	-15	-18	-32	-39	23	22	15	21	
10,000	19	14	12	12	14	3	-2	-20	-15	-13	-13	-15	-26	-32	18	18	12	16	
5,000	11	9	7	7	8	-1	-6	-12	-9	-8	-8	-9	-18	-24	16	15	11	13	
LEBANON TO MONTPELIER																			36 N.MI.
15,000	-9	-10	-8	-6	-8	-21	-29	4	8	7	3	5	-8	-15	23	22	15	21	
10,000	-10	-9	-8	-6	-8	-19	-25	7	7	7	5	7	-4	-10	18	18	13	16	
5,000	-7	-5	-4	-3	-5	-14	-19	6	5	4	3	4	-5	-10	16	16	12	13	
LEWISTON, TO PORTLAND, ME.																			29 N.MI.
15,000	-16	-6	-5	-11	-9	-23	-31	12	4	4	8	6	-7	-14	23	22	15	22	
10,000	-7	-2	-2	-5	-4	-15	-21	5	1	1	4	2	-8	-14	18	18	13	16	
5,000	-2	-1	-3	-3	-2	-11	-16	1	0	2	2	1	-8	-13	16	16	12	13	
LEXINGTON TO LOUISVILLE																			54 N.MI.
15,000	-39	-28	-14	-21	-24	-39	-48	38	27	14	20	23	10	4	21	21	12	20	
10,000	-28	-21	-12	-16	-19	-30	-36	28	20	11	15	18	8	2	16	17	12	15	
5,000	-15	-11	-7	-8	-10	-19	-24	15	11	7	8	10	1	-4	15	15	10	13	
LINCOLN TO OMAHA																			0 N.MI.
15,000	31	21	17	21	22	10	3	-32	-22	-17	-22	-22	-36	-43	21	20	13	19	
10,000	22	15	11	14	15	6	0	-23	-16	-12	-15	-16	-26	-32	15	16	12	15	
5,000	10	8	6	9	8	-1	-5	-11	-8	-7	-10	-9	-18	-23	14	15	11	13	
LITTLE ROCK TO MEMPHIS																			113 N.MI.
15,000	37	26	8	16	19	7	1	-38	-27	-8	-17	-20	-36	-44	20	19	11	18	
10,000	26	18	7	11	15	5	0	-26	-19	-7	-12	-15	-26	-32	14	15	10	14	
5,000	13	10	6	5	8	0	-5	-14	-11	-7	-5	-9	-18	-23	14	14	10	12	
LITTLE ROCK TO ST. LOUIS																			257 N.MI.
15,000	14	8	4	4	7	-4	-10	-18	-10	-4	-6	-9	-21	-28	19	19	11	18	
10,000	11	6	4	4	6	-3	-8	-12	-7	-4	-5	-7	-16	-21	14	15	11	14	
5,000	6	5	4	2	4	-4	-9	-7	-5	-4	-3	-5	-13	-18	14	14	10	12	
LITTLE ROCK TO SHREVEPORT																			158 N.MI.
15,000	-22	-14	-4	-8	-11	-23	-30	20	12	3	6	9	-1	-7	19	18	11	17	
10,000	-15	-11	-5	-5	-8	-18	-23	14	10	5	5	8	-1	-6	14	14	10	14	
5,000	-9	-8	-6	-4	-7	-15	-20	8	7	6	3	6	-2	-6	14	14	9	12	

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	D I R E C T							R E T U R N														
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
LITTLE ROCK TO SPRINGFIELD, MD.																			161 N.MI.			
15,000	-11	-10	-4	-8	-7	-19	-26	8	8	3	7	6	-5	-11	20	19	11	18				
10,000	-8	-6	-2	-5	-5	-14	-19	6	5	1	4	4	-5	-10	14	15	11	14				
5,000	-3	-2	0	-2	-1	-10	-15	2	1	0	1	1	-7	-12	14	14	10	12				
LONG BEACH TO LOS ANGELES																			14 N.MI.			
15,000	-21	-17	-5	-8	-11	-24	-31	20	16	4	7	11	0	-6	21	18	11	16				
10,000	-12	-11	-2	-5	-7	-16	-21	12	11	1	4	6	-2	-6	15	14	9	12				
5,000	-6	-5	-3	0	-3	-9	-13	5	4	3	0	3	-3	-6	10	9	7	9				
LONG BEACH TO SAN DIEGO																			81 N.MI.			
15,000	15	12	0	4	6	-4	-10	-17	-13	0	-5	-7	-19	-27	20	17	11	15				
10,000	10	9	-1	2	4	-4	-8	-10	-10	1	-3	-5	-14	-19	15	13	9	12				
5,000	5	5	1	1	3	-3	-6	-6	-5	-1	-1	-3	-9	-12	10	9	6	8				
LOS ANGELES TO ONTARIO																			40 N.MI.			
15,000	19	17	8	8	12	1	-4	-20	-18	-9	-9	-13	-25	-31	21	18	11	16				
10,000	10	9	4	6	7	-1	-6	-11	-10	-5	-6	-7	-16	-21	15	14	9	12				
5,000	4	2	4	-3	2	-4	-8	-4	-2	-4	3	-2	-8	-11	10	9	7	9				
LOS ANGELES TO PALM SPRINGS																			95 N.MI.			
15,000	20	18	7	8	12	2	-4	-21	-19	-7	-9	-13	-25	-32	20	18	11	16				
10,000	12	10	3	6	7	-1	-5	-12	-11	-4	-6	-7	-16	-21	15	13	9	12				
5,000	5	3	4	-3	2	-4	-7	-5	-3	-4	3	-2	-8	-12	10	9	7	8				
LOS ANGELES TO PHOENIX																			320 N.MI.			
15,000	21	18	6	9	12	2	-3	-22	-19	-7	-9	-13	-25	-32	19	16	10	15				
10,000	12	11	3	6	7	0	-4	-13	-11	-4	-6	-8	-16	-20	14	12	8	11				
5,000	3	3	2	-4	1	-4	-7	-3	-3	-2	4	-1	-6	-9	9	8	6	8				
LOS ANGELES TO SACRAMENTO																			309 N.MI.			
15,000	-16	-11	-2	-5	-7	-19	-26	14	10	1	4	6	-4	-10	20	18	11	16				
10,000	-11	-9	1	-3	-5	-14	-19	10	9	-1	3	4	-4	-8	15	14	9	12				
5,000	-4	-4	-3	-4	-4	-9	-13	4	4	3	3	3	-2	-5	10	9	7	9				
LOS ANGELES TO SAN DIEGO																			94 N.MI.			
15,000	16	13	0	4	7	-3	-9	-17	-14	-1	-5	-8	-20	-27	20	17	11	15				
10,000	10	10	-1	3	5	-4	-8	-11	-10	1	-3	-5	-14	-19	15	13	9	12				
5,000	5	5	1	1	3	-3	-6	-6	-5	-1	-1	-3	-9	-12	10	9	6	8				
LOS ANGELES TO SAN FRANCISCO																			295 N.MI.			
15,000	-19	-14	-4	-7	-10	-22	-29	18	13	4	6	9	-2	-7	20	18	11	16				
10,000	-12	-11	-1	-5	-6	-16	-21	11	10	1	4	6	-3	-7	15	14	9	12				
5,000	-5	-5	-3	-3	-4	-10	-13	5	5	3	3	4	-2	-5	11	9	7	9				
LOS ANGELES TO SANTA BARBARA																			77 N.MI.			
15,000	-21	-18	-6	-8	-12	-24	-32	20	17	6	7	11	0	-5	21	18	11	16				
10,000	-12	-12	-2	-5	-7	-16	-22	12	11	2	5	7	-2	-6	15	14	9	12				
5,000	-6	-4	-4	0	-3	-9	-13	5	4	4	0	3	-3	-6	11	9	7	9				
LOS ANGELES TO TUCSON																			390 N.MI.			
15,000	21	18	4	8	11	1	-4	-22	-19	-4	-8	-12	-24	-31	18	16	10	14				
10,000	13	11	2	5	7	-1	-4	-13	-11	-2	-5	-7	-15	-20	13	11	8	11				
5,000	1	1	1	-4	0	-5	-8	-1	-1	-1	4	0	-5	-8	9	8	5	8				
LOUISVILLE TO MEMPHIS																			277 N.MI.			
15,000	-32	-21	-9	-15	-17	-31	-40	30	19	8	13	16	5	-1	19	19	11	18				
10,000	-23	-15	-8	-11	-13	-24	-29	22	14	7	10	13	3	-2	14	15	11	14				
5,000	-12	-9	-5	-5	-7	-16	-21	11	8	5	5	7	-1	-6	14	14	9	12				
LOUISVILLE TO NASHVILLE																			131 N.MI.			
15,000	-19	-10	-5	-8	-9	-22	-29	15	8	4	6	8	-4	-10	20	20	12	19				
10,000	-12	-7	-4	-6	-7	-17	-22	10	6	4	5	6	-3	-9	15	16	11	15				
5,000	-6	-4	-3	-3	-4	-12	-17	6	4	2	2	3	-5	-10	14	14	10	13				
LOUISVILLE TO OWENSBORO																			73 N.MI.			
15,000	-38	-26	-13	-20	-23	-37	-46	37	24	13	19	22	9	3	20	21	12	20				
10,000	-27	-19	-11	-15	-17	-28	-34	27	18	10	14	17	6	1	15	16	12	15				
5,000	-14	-10	-7	-8	-9	-18	-24	14	10	6	7	9	0	-4	15	15	10	13				

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HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
LOUISVILLE TO ST. LOUIS																		
15,000	-39	-27	-15	-21	-24	-38	-46	37	26	14	20	23	11	4	20	20	12	19
10,000	-28	-20	-12	-15	-18	-29	-35	27	20	11	15	18	8	2	15	16	11	15
5,000	-15	-11	-7	-9	-10	-19	-24	14	10	6	8	9	1	-3	14	14	10	12
220 N.MI.																		
LUBBOCK TO MIDLAND																		
15,000	-8	-7	-5	-2	-5	-16	-22	6	5	5	1	4	-6	-12	19	17	11	16
10,000	-6	-6	-4	-3	-5	-13	-17	5	5	4	2	4	-4	-8	14	13	10	12
5,000	-7	-7	-10	-6	-8	-15	-19	6	7	10	5	7	0	-5	13	12	9	11
105 N.MI.																		
LUBBOCK TO WICHITA FALLS																		
15,000	30	24	6	13	17	5	0	-31	-25	-6	-14	-17	-31	-39	19	17	11	16
10,000	20	15	5	9	12	3	-2	-21	-16	-5	-9	-12	-22	-27	14	13	10	13
5,000	8	7	6	5	6	-2	-6	-8	-7	-7	-5	-7	-15	-19	14	14	10	12
166 N.MI.																		
MACON TO SAVANNAH																		
15,000	30	25	6	13	17	5	0	-31	-26	-6	-14	-17	-32	-39	18	18	10	17
10,000	21	17	4	8	12	2	-2	-22	-17	-5	-9	-12	-23	-29	14	15	10	13
5,000	9	8	4	4	6	-2	-6	-9	-8	-4	-4	-6	-14	-18	13	12	9	12
134 N.MI.																		
MACON TO WAYCROSS																		
15,000	15	15	2	7	9	-2	-7	-18	-16	-3	-8	-10	-22	-29	18	18	10	16
10,000	10	10	1	4	6	-3	-8	-12	-10	-1	-4	-6	-16	-21	14	15	10	13
5,000	2	3	1	2	2	-6	-10	-3	-4	-1	-2	-2	-10	-14	13	12	9	12
107 N.MI.																		
MADISON TO MILWAUKEE																		
15,000	34	22	19	22	24	11	4	-35	-23	-20	-23	-25	-38	-46	21	21	14	20
10,000	26	17	15	17	18	8	2	-26	-18	-15	-17	-19	-29	-35	16	17	13	15
5,000	14	8	7	10	10	0	-4	-14	-9	-8	-11	-10	-20	-25	15	16	11	14
64 N.MI.																		
MADISON TO ROCHESTER, MINN.																		
15,000	-33	-22	-20	-22	-24	-37	-44	32	21	19	22	23	11	4	20	20	13	20
10,000	-25	-16	-15	-17	-18	-28	-34	24	16	14	16	17	7	2	15	16	13	15
5,000	-13	-8	-7	-10	-10	-19	-24	13	7	7	10	9	0	-5	14	15	11	14
145 N.MI.																		
MANCHESTER TO WORCESTER																		
15,000	-20	-10	-8	-13	-12	-26	-34	17	7	6	11	10	-3	-10	23	22	14	21
10,000	-11	-6	-4	-8	-7	-18	-24	9	4	4	7	6	-5	-11	18	18	12	16
5,000	-5	-2	-4	-4	-4	-13	-18	4	2	3	4	3	-6	-11	16	15	11	13
51 N.MI.																		
MARTHAS VINEYARD TO NEW BEDFORD																		
15,000	-25	-22	-15	-15	-19	-32	-40	21	20	14	13	17	4	-3	23	22	14	21
10,000	-22	-17	-12	-12	-15	-27	-33	20	16	12	11	14	4	-2	18	18	12	16
5,000	-12	-11	-8	-8	-9	-19	-24	11	10	7	7	9	-1	-6	16	16	11	13
22 N.MI.																		
MEOFORO TO SACRAMENTO																		
15,000	10	6	2	4	5	-7	-13	-12	-8	-2	-5	-6	-18	-25	22	19	12	18
10,000	7	4	0	2	3	-6	-11	-8	-5	0	-3	-3	-13	-18	16	15	10	14
5,000	-1	-1	4	0	1	-6	-9	0	1	-4	0	-1	-7	-10	12	9	7	9
243 N.MI.																		
MEOFORO TO SAN FRANCISCO																		
15,000	5	3	-1	0	1	-10	-16	-7	-4	0	-2	-3	-15	-21	21	19	12	18
10,000	4	2	-2	0	1	-8	-13	-5	-3	1	-1	-1	-11	-16	16	15	9	13
5,000	-2	-1	3	0	0	-6	-10	1	1	-3	0	-1	-7	-10	12	9	7	9
286 N.MI.																		
MELBOURNE TO MIAMI																		
15,000	4	4	-4	-2	0	-8	-13	-5	-5	4	2	0	-9	-14	15	14	8	12
10,000	-1	1	-5	-4	-2	-9	-13	0	-2	5	3	2	-5	-10	12	12	8	11
5,000	-6	-4	-5	-5	-5	-11	-15	6	4	5	4	5	-2	-5	11	10	7	10
139 N.MI.																		
MELBOURNE TO ORLANDO																		
15,000	-20	-18	1	-6	-9	-22	-28	19	17	-1	6	9	-1	-6	16	15	9	14
10,000	-10	-10	1	-2	-5	-14	-19	10	10	-2	2	4	-4	-8	13	13	8	12
5,000	2	-2	1	1	1	-6	-10	-3	1	-1	-1	-1	-8	-12	12	11	8	11
46 N.MI.																		
MELBOURNE TO TAMPA																		
15,000	-23	-21	-2	-9	-12	-24	-31	23	20	2	9	12	2	-3	15	15	9	13
10,000	-14	-13	-1	-5	-7	-16	-21	13	12	1	5	7	-1	-5	13	12	8	11
5,000	-2	-5	-2	-2	-3	-10	-13	2	5	1	2	2	-4	-8	11	11	8	11
101 N.MI.																		

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
MELBOURNE TO VERO BEACH																				
15,000	9	9	-3	1	3	-6	-11	-11	-10	3	-1	-3	-14	-20	16	15	29 N.MI.	9 13		
10,000	3	4	-4	-2	0	-8	-12	-3	-5	4	1	0	-8	-13	13	13	8 12			
5,000	-6	-3	-4	-4	-4	-11	-15	6	2	4	3	4	-3	-7	11	11	8 11			
MELBOURNE TO WEST PALM BEACH																				
15,000	7	7	-4	0	2	-7	-11	-9	-8	4	0	-2	-12	-18	15	15	90 N.MI.	8 13		
10,000	1	3	-4	-3	-1	-8	-12	-2	-4	4	2	1	-7	-12	13	12	8 11			
5,000	-7	-3	-4	-4	-5	-11	-15	6	3	4	4	4	-2	-6	11	11	8 10			
MEMPHIS TO NASHVILLE																				
15,000	37	25	9	16	20	7	1	-38	-26	-9	-17	-20	-36	-44	20	19	173 N.MI.	11 19		
10,000	26	18	8	12	15	5	0	-27	-18	-8	-12	-16	-27	-33	15	15	10 14			
5,000	14	10	6	5	8	0	-5	-14	-11	-6	-5	-9	-17	-23	14	14	9 12			
MEMPHIS TO NEW ORLEANS																				
15,000	-9	-2	1	-1	-2	-13	-19	6	0	-1	0	1	-9	-15	17	17	304 N.MI.	10 16		
10,000	-6	-3	-3	0	-3	-11	-16	4	2	3	-1	2	-6	-11	13	14	10 13			
5,000	-5	-4	-3	0	-3	-11	-15	4	3	3	0	2	-5	-9	13	13	9 12			
MEMPHIS TO PADUCAH																				
15,000	20	11	4	7	9	-2	-8	-23	-13	-5	-8	-11	-24	-32	20	20	134 N.MI.	11 19		
10,000	14	8	4	5	8	-2	-7	-16	-9	-5	-6	-9	-19	-24	15	15	11 15			
5,000	7	6	3	2	5	-4	-8	-8	-6	-4	-3	-5	-14	-19	15	14	10 13			
MEMPHIS TO ST. LOUIS																				
15,000	-1	-3	-1	-4	-2	-14	-20	-3	1	1	2	0	-11	-17	19	19	222 N.MI.	12 19		
10,000	0	-2	0	-2	-1	-10	-15	-2	1	0	1	0	-9	-14	14	15	11 14			
5,000	0	0	0	-1	0	-8	-13	-1	-1	-1	0	-1	-9	-13	14	14	10 12			
MEMPHIS TO SHREVEPORT																				
15,000	-31	-21	-5	-12	-16	-30	-38	29	20	5	11	15	3	-2	19	18	247 N.MI.	11 17		
10,000	-22	-15	-6	-8	-12	-22	-27	21	14	6	8	11	2	-2	14	14	10 13			
5,000	-12	-10	-6	-4	-8	-16	-21	11	9	6	4	7	-1	-5	14	14	9 12			
MERCED TO MODESTO																				
15,000	-20	-14	-6	-8	-11	-24	-31	18	13	5	7	10	-2	-8	22	19	29 N.MI.	12 18		
10,000	-13	-10	-2	-6	-7	-17	-22	12	10	1	5	6	-3	-7	16	15	10 13			
5,000	-5	-4	-4	-5	-4	-11	-14	4	4	4	4	4	-2	-6	12	10	7 9			
MERIDIAN TO MONROE																				
15,000	-33	-26	-6	-15	-18	-33	-41	32	25	6	14	18	6	0	18	18	167 N.MI.	11 17		
10,000	-23	-17	-4	-10	-13	-23	-29	22	16	4	9	12	3	-2	14	14	10 14			
5,000	-12	-9	-4	-5	-7	-15	-20	11	8	4	4	7	-1	-6	14	13	9 12			
MERIDIAN TO MONTGOMERY																				
15,000	33	25	6	14	18	6	0	-33	-26	-6	-15	-18	-33	-41	18	18	119 N.MI.	10 17		
10,000	23	17	5	9	12	3	-2	-23	-17	-5	-10	-13	-24	-30	14	15	10 14			
5,000	11	9	4	4	7	-1	-6	-11	-9	-4	-5	-7	-15	-20	13	13	9 12			
MIAMI TO ORLANDO																				
15,000	-8	-8	4	0	-2	-12	-17	7	7	-4	0	1	-7	-11	15	14	174 N.MI.	8 12		
10,000	-2	-3	4	2	1	-7	-11	1	3	-5	-3	-1	-8	-12	12	12	8 11			
5,000	6	3	4	4	5	-2	-5	-7	-4	-5	-4	-5	-11	-15	11	10	7 10			
MIAMI TO ST. PETERSBURG																				
15,000	-15	-15	3	-4	-6	-17	-23	14	14	-3	3	6	-3	-8	15	14	181 N.MI.	8 12		
10,000	-6	-7	4	0	-2	-10	-14	6	7	-4	0	1	-6	-10	12	11	8 11			
5,000	5	1	4	3	3	-3	-7	-6	-1	-4	-4	-4	-10	-14	11	10	7 10			
MIAMI TO TALLAHASSEE																				
15,000	-15	-14	1	-4	-7	-17	-23	14	13	-2	4	6	-3	-7	15	14	350 N.MI.	8 13		
10,000	-7	-7	3	-1	-2	-11	-15	6	7	-3	1	2	-5	-9	12	12	8 11			
5,000	4	0	3	2	2	-4	-8	-4	-1	-3	-2	-2	-9	-12	11	10	7 10			
MIAMI TO TAMPA																				
15,000	-14	-14	3	-3	-6	-17	-23	13	13	-3	3	5	-4	-8	15	14	177 N.MI.	8 12		
10,000	-6	-7	4	0	-1	-10	-14	5	6	-4	0	1	-6	-10	12	11	8 11			
5,000	5	1	4	4	4	-3	-6	-6	-2	-4	-4	-4	-10	-14	11	10	7 10			

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*							STANDARD DEVIATION			
	D I R E C T								R E T U R N										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT	
MIAMI TO WEST PALM BEACH																			
15,000	0	0	3	4	2	-6	-10	-2	-1	-4	-4	-3	-11	-15	15	14	8	12	
10,000	3	2	4	4	3	-4	-8	-3	-2	-4	-5	-4	-10	-14	12	11	8	11	
5,000	4	5	4	4	4	-2	-6	-4	-5	-4	-4	-4	-11	-14	11	10	7	10	
MIDLAND TO SAN ANGELO																			
15,000	26	21	1	10	13	1	-4	-27	-21	-1	-11	-14	-27	-35	18	16	11	16	
10,000	16	12	2	6	8	0	-5	-17	-12	-2	-6	-9	-18	-23	14	13	10	12	
5,000	4	1	-2	-1	0	-7	-11	-5	-2	2	0	-1	-9	-13	13	13	8	11	
MILWAUKEE TO MINNEAPOLIS																			
15,000	-32	-21	-19	-22	-23	-36	-43	31	20	19	21	22	10	4	20	19	13	19	
10,000	-24	-16	-15	-16	-17	-27	-33	23	15	14	16	17	7	2	15	16	12	15	
5,000	-13	-8	-7	-10	-9	-18	-23	13	7	7	9	9	0	-5	14	15	11	13	
MILWAUKEE TO MUSKEGON																			
15,000	34	22	19	21	23	10	4	-35	-23	-19	-22	-24	-38	-45	21	21	14	20	
10,000	25	16	14	17	18	7	2	-26	-17	-15	-17	-18	-29	-35	16	17	13	15	
5,000	14	8	8	10	10	1	-4	-14	-8	-8	-11	-10	-19	-25	15	16	11	13	
MILWAUKEE TO TOLEDO																			
15,000	34	23	18	21	23	11	4	-36	-24	-18	-22	-24	-38	-45	20	20	13	20	
10,000	25	17	14	16	18	8	2	-26	-18	-14	-17	-18	-29	-35	16	17	12	15	
5,000	14	9	7	9	10	1	-4	-14	-10	-8	-10	-10	-19	-24	15	15	10	13	
MINNEAPOLIS TO OMAHA																			
15,000	-14	-10	-10	-10	-11	-22	-29	12	8	9	8	9	-2	-9	19	19	13	18	
10,000	-10	-6	-6	-6	-7	-16	-21	8	5	6	5	6	-3	-8	14	15	12	14	
5,000	-4	-3	-5	-4	-4	-12	-17	3	2	4	4	3	-5	-10	13	14	11	13	
MINNEAPOLIS TO ROCHESTER, MINN.																			
15,000	18	12	11	13	13	1	-5	-20	-14	-12	-15	-15	-27	-35	20	20	14	20	
10,000	14	10	9	10	11	1	-5	-16	-10	-9	-11	-12	-22	-27	15	16	13	15	
5,000	8	5	3	6	6	-4	-9	-9	-6	-3	-7	-6	-16	-21	14	15	12	14	
MINNEAPOLIS TO SIOUX FALLS																			
15,000	-25	-16	-17	-20	-19	-32	-38	24	15	17	18	18	7	0	20	19	13	19	
10,000	-18	-11	-12	-13	-13	-23	-28	17	10	11	12	13	3	-2	15	15	12	15	
5,000	-9	-5	-6	-8	-7	-16	-21	9	4	6	8	6	-3	-7	14	15	12	14	
MINNEAPOLIS TO WINNIPEG																			
15,000	-20	-14	-13	-16	-15	-27	-33	18	13	11	14	14	3	-3	18	18	13	17	
10,000	-16	-10	-10	-12	-12	-21	-26	15	10	9	11	11	2	-3	14	14	12	14	
5,000	-9	-5	-3	-8	-6	-15	-20	8	4	3	7	6	-3	-8	13	14	12	14	
MISSOULA TO SPOKANE																			
15,000	-26	-16	-15	-21	-19	-31	-38	25	15	14	20	18	7	1	19	18	13	18	
10,000	-19	-12	-8	-14	-13	-22	-27	19	11	8	14	13	4	0	14	13	10	12	
5,000	-8	-5	-4	-5	-5	-12	-16	7	4	4	4	5	-2	-6	12	10	9	11	
MOBILE TO MONTGOMERY																			
15,000	25	17	3	9	12	1	-4	-26	-18	-3	-10	-13	-26	-34	17	17	10	16	
10,000	17	12	5	6	9	1	-4	-18	-13	-5	-6	-10	-20	-25	14	14	10	13	
5,000	10	8	4	3	6	-2	-6	-11	-8	-5	-3	-7	-15	-19	13	13	9	12	
MOBILE TO NEW ORLEANS																			
15,000	-30	-23	-3	-12	-16	-29	-37	29	22	3	11	15	3	-2	17	17	10	16	
10,000	-20	-15	-4	-7	-11	-21	-26	20	15	3	6	10	1	-3	14	14	10	13	
5,000	-11	-8	-4	-4	-6	-15	-19	11	8	4	4	6	-2	-6	13	13	9	12	
MOBILE TO PENSACOLA																			
15,000	28	23	4	12	15	4	-2	-29	-24	-5	-12	-16	-30	-37	17	17	10	16	
10,000	19	14	2	7	10	0	-4	-19	-15	-2	-8	-10	-21	-26	14	14	10	13	
5,000	8	6	2	4	5	-3	-7	-8	-7	-2	-4	-5	-13	-18	13	13	9	12	
MODESTO TO STOCKTON																			
15,000	-19	-14	-5	-8	-11	-23	-31	18	13	5	7	10	-2	-8	22	20	12	18	
10,000	-13	-10	-2	-5	-7	-17	-22	12	9	2	5	6	-3	-8	17	15	10	14	
5,000	-4	-4	-4	-5	-4	-11	-14	4	4	4	4	4	-2	-6	12	10	7	9	

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HEIGHT IN FEET	EQUIVALENT HEADWINDS*								STANDARD DEVIATION									
	D I R E C T								R E T U R N									
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
MONCTON TO MONTREAL																		
15,000	-35	-23	-23	-27	-26	-40	-47	34	22	22	26	26	13	6	21	20	14	20
10,000	-27	-16	-17	-20	-19	-30	-36	26	15	16	19	19	9	3	17	16	12	15
5,000	-15	-10	-12	-13	-12	-21	-26	14	9	12	12	12	3	-2	15	14	11	13
MONCTON TO ST. JOHN																		
15,000	-30	-19	-17	-23	-22	-36	-44	28	17	16	22	20	6	-1	23	23	16	22
10,000	-21	-12	-12	-15	-15	-26	-33	20	11	11	14	14	3	-3	19	18	13	17
5,000	-10	-7	-10	-10	-9	-19	-24	9	6	10	9	8	-1	-7	16	16	12	14
MONROE TO SHREVEPORT																		
15,000	-33	-26	-6	-14	-18	-33	-40	32	25	6	14	17	5	0	18	18	11	17
10,000	-23	-17	-5	-9	-12	-23	-29	22	16	4	9	12	3	-2	14	14	10	13
5,000	-11	-9	-5	-5	-7	-16	-20	11	8	5	4	7	-1	-6	14	14	9	12
MONTEREY TO SALINAS																		
15,000	16	14	10	9	12	0	-6	-17	-15	-10	-10	-13	-25	-32	22	19	12	18
10,000	9	8	6	6	7	-2	-7	-10	-8	-6	-7	-7	-17	-22	17	15	10	13
5,000	4	3	3	1	3	-4	-7	-5	-3	-3	-1	-3	-9	-13	12	10	8	10
MONTEREY TO SAN FRANCISCO																		
15,000	-14	-10	-3	-5	-7	-19	-26	12	8	2	4	6	-6	-12	22	19	12	18
10,000	-10	-8	0	-3	-5	-14	-20	9	7	0	3	4	-5	-10	17	15	10	13
5,000	-3	-4	-4	-4	-4	-10	-14	3	4	4	4	4	-3	-6	12	10	8	10
MONTEREY TO SANTA BARBARA																		
15,000	17	12	3	5	8	-3	-8	-18	-13	-4	-6	-9	-21	-29	21	18	11	17
10,000	11	10	0	4	5	-3	-8	-12	-11	-1	-4	-6	-16	-21	16	14	9	13
5,000	5	5	3	3	4	-2	-5	-6	-5	-4	-4	-4	-11	-14	11	10	7	9
MONTGOMERY TO PENSACOLA																		
15,000	-16	-10	-2	-6	-7	-19	-25	14	8	1	5	6	-4	-9	17	17	10	16
10,000	-11	-8	-4	-3	-6	-15	-20	10	7	4	3	6	-3	-7	14	14	10	13
5,000	-8	-6	-4	-2	-5	-13	-17	8	6	4	2	5	-3	-7	13	13	9	12
MONTREAL TO NEW YORK																		
15,000	-7	0	0	-5	-2	-15	-22	2	-3	-1	2	0	-13	-19	21	21	14	20
10,000	-1	2	2	-2	0	-10	-16	-1	-3	-3	0	-2	-12	-17	17	17	12	15
5,000	0	1	0	-1	0	-8	-13	-1	-2	-1	0	-1	-10	-15	15	15	11	12
MONTREAL TO OTTAWA																		
15,000	-36	-23	-22	-26	-26	-40	-48	35	22	22	25	25	12	5	22	22	15	21
10,000	-27	-16	-16	-20	-19	-31	-37	26	15	16	19	19	8	2	18	18	13	16
5,000	-15	-10	-11	-12	-12	-21	-27	15	9	11	11	11	2	-3	16	16	12	13
MONTREAL TO QUEBEC																		
15,000	28	15	15	20	19	6	-1	-30	-16	-17	-22	-21	-35	-42	22	21	15	21
10,000	19	9	10	14	13	2	-4	-20	-10	-11	-15	-14	-25	-31	18	17	13	16
5,000	9	5	8	10	8	-1	-6	-10	-6	-9	-10	-9	-18	-23	16	15	12	13
MONTREAL TO SAGUENAY																		
15,000	20	9	9	14	12	0	-7	-22	-11	-11	-16	-14	-28	-35	21	20	15	20
10,000	12	4	5	9	7	-3	-8	-13	-5	-6	-10	-9	-19	-25	17	16	12	16
5,000	5	3	5	7	5	-4	-9	-6	-3	-6	-8	-6	-15	-20	15	15	12	13
MONTREAL TO ST. JOHN																		
15,000	34	22	23	26	26	13	6	-35	-24	-23	-27	-27	-40	-47	21	21	14	20
10,000	27	16	17	20	19	9	4	-27	-17	-17	-20	-20	-31	-36	17	17	12	15
5,000	14	9	12	12	12	3	-2	-15	-10	-12	-12	-12	-21	-26	15	15	11	13
MONTREAL TO TORONTO																		
15,000	-36	-21	-20	-24	-24	-38	-46	34	20	19	23	23	11	4	21	21	14	20
10,000	-26	-15	-14	-18	-18	-29	-35	25	14	13	17	17	7	1	17	17	12	15
5,000	-14	-9	-9	-11	-11	-20	-25	14	8	9	11	10	1	-3	15	15	11	13
MUSCLE SHOALS TO NASHVILLE																		
15,000	22	12	4	8	11	-1	-7	-25	-14	-5	-10	-12	-26	-34	20	20	11	19
10,000	15	9	4	6	8	-1	-6	-17	-10	-5	-7	-9	-19	-25	15	16	11	15
5,000	8	6	3	2	5	-4	-8	-9	-7	-3	-3	-5	-14	-19	14	14	10	13

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
NASHVILLE TO ST. LOUIS																		
15,000	-28	-21	-10	-16	-17	-30	-38	25	19	9	15	16	4	-2	19	19	12	19
10,000	-20	-15	-7	-11	-13	-23	-29	19	14	7	10	12	3	-2	15	15	11	14
5,000	-11	-8	-4	-6	-7	-15	-20	10	7	4	5	6	-2	-6	14	14	10	12
NEW BEDFORD TO NEW YORK																		
15,000	-39	-27	-18	-24	-26	-40	-49	38	25	18	23	25	12	5	22	21	13	20
10,000	-28	-20	-14	-18	-19	-31	-37	27	19	14	17	18	8	3	18	18	12	15
5,000	-14	-11	-9	-10	-11	-20	-25	14	10	9	9	10	1	-4	15	15	11	13
NEW BERN TO NORFOLK																		
15,000	16	9	5	10	9	-2	-8	-19	-11	-5	-11	-11	-23	-30	20	20	11	19
10,000	9	8	4	6	6	-3	-8	-11	-9	-4	-7	-7	-17	-23	16	16	11	15
5,000	5	4	2	2	3	-5	-9	-6	-5	-3	-3	-4	-12	-17	14	13	10	13
NEW HAVEN TO NEW YORK																		
15,000	-34	-21	-15	-21	-22	-36	-44	32	19	14	20	20	7	0	22	22	13	21
10,000	-23	-16	-11	-15	-16	-27	-33	21	15	10	15	15	4	-1	18	18	12	16
5,000	-12	-8	-7	-8	-8	-18	-23	11	7	7	7	8	-1	-6	15	15	11	13
NEW ORLEANS TO SHREVEPORT																		
15,000	-22	-19	-4	-10	-13	-25	-32	20	18	4	10	12	2	-4	17	16	10	16
10,000	-14	-11	0	-7	-8	-17	-22	13	10	0	6	7	-2	-6	13	13	10	13
5,000	-5	-3	0	-3	-3	-11	-15	5	3	0	3	2	-5	-9	13	13	9	12
NEWPORT NEWS TO NEW YORK																		
15,000	23	13	9	15	14	2	-4	-26	-15	-10	-16	-16	-29	-36	21	20	12	19
10,000	15	10	6	10	10	0	-5	-17	-12	-7	-11	-11	-21	-27	16	17	11	15
5,000	8	5	4	5	5	-3	-8	-9	-6	-4	-5	-6	-14	-19	14	14	10	12
NEWPORT NEWS TO NORFOLK																		
15,000	24	22	9	11	15	3	-3	-27	-24	-10	-12	-17	-31	-39	21	21	12	19
10,000	20	16	8	9	13	3	-3	-22	-17	-9	-10	-14	-25	-31	17	17	11	15
5,000	11	9	5	4	7	-2	-6	-11	-9	-5	-5	-7	-16	-21	15	14	10	13
NEWPORT NEWS TO WASHINGTON, D.C.																		
15,000	-9	-11	-4	-2	-6	-18	-25	4	8	3	0	4	-8	-15	21	21	12	19
10,000	-8	-7	-4	-3	-5	-15	-21	6	6	3	2	4	-6	-11	17	17	11	15
5,000	-4	-4	-2	-2	-3	-12	-16	3	4	2	1	3	-6	-11	14	14	10	13
NEW YORK TO NORFOLK																		
15,000	-24	-13	-8	-15	-14	-27	-34	20	11	8	13	12	0	-6	20	20	12	19
10,000	-15	-10	-6	-10	-10	-20	-26	12	9	5	9	8	-1	-6	16	17	11	15
5,000	-8	-5	-4	-4	-5	-13	-18	7	4	3	4	4	-4	-8	14	14	10	12
NEW YORK TO PHILADELPHIA																		
15,000	-38	-25	-16	-23	-24	-39	-47	36	23	16	22	23	10	3	22	22	13	20
10,000	-26	-19	-12	-17	-18	-29	-35	25	18	12	16	17	6	1	17	18	12	15
5,000	-14	-10	-7	-9	-10	-19	-24	13	9	7	8	9	0	-5	15	15	11	13
NEW YORK TO PROVIDENCE																		
15,000	36	23	17	22	23	11	4	-38	-25	-17	-23	-25	-39	-47	22	21	13	20
10,000	25	18	13	17	17	7	1	-26	-19	-13	-17	-18	-29	-36	18	18	12	15
5,000	13	9	8	9	9	1	-4	-14	-10	-8	-9	-10	-19	-24	15	15	11	13
NEW YORK TO PITTSBURGH																		
15,000	-43	-29	-19	-25	-28	-42	-50	42	28	19	24	27	14	8	21	20	12	19
10,000	-31	-22	-15	-20	-21	-32	-38	30	22	15	19	21	11	5	16	17	11	15
5,000	-16	-12	-9	-10	-12	-20	-25	16	12	9	10	11	3	-2	14	14	10	12
NEW YORK TO PORTLAND, ME.																		
15,000	28	16	13	18	18	6	-1	-31	-18	-14	-20	-20	-34	-41	22	21	13	20
10,000	18	11	9	13	12	2	-3	-20	-13	-10	-14	-14	-24	-30	17	17	12	15
5,000	9	6	6	7	7	-2	-7	-10	-6	-7	-7	-8	-16	-21	15	15	11	13
NEW YORK TO RALEIGH																		
15,000	-30	-19	-11	-18	-18	-31	-39	27	16	10	16	16	5	-1	20	19	11	18
10,000	-20	-14	-8	-13	-13	-23	-29	18	13	8	12	12	3	-2	16	16	11	14
5,000	-10	-7	-5	-6	-7	-15	-20	10	7	5	5	6	-2	-6	14	13	9	12

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
NEW YORK TO READING																		
15,000	-42	-30	-19	-25	-28	-43	-51	41	28	19	24	27	14	7	22	22	13	20
10,000	-31	-23	-15	-19	-21	-33	-39	30	22	15	19	21	10	5	17	18	12	15
5,000	-16	-12	-9	-10	-12	-21	-26	15	12	9	10	11	2	-2	15	15	11	13
NEW YORK TO RICHMOND																		
15,000	-32	-19	-12	-19	-19	-33	-41	29	17	11	18	18	6	-1	21	20	12	19
10,000	-21	-15	-9	-13	-14	-25	-30	19	13	8	13	13	3	-2	16	17	11	15
5,000	-11	-7	-5	-6	-7	-16	-21	10	7	5	6	7	-2	-6	14	14	10	12
NEW YORK TO ROCHESTER, N.Y.																		
15,000	-30	-24	-16	-17	-21	-34	-42	27	22	15	16	19	7	0	21	21	13	20
10,000	-23	-18	-13	-14	-17	-27	-33	22	17	13	13	16	6	0	17	17	12	15
5,000	-13	-10	-8	-8	-10	-18	-23	12	10	8	7	9	0	-4	15	15	10	13
NEW YORK TO SCRANTON																		
15,000	-35	-27	-18	-20	-24	-38	-46	33	26	17	19	23	10	3	22	22	13	20
10,000	-27	-21	-15	-16	-19	-30	-36	26	20	14	15	18	8	2	17	18	12	15
5,000	-14	-12	-9	-9	-11	-20	-25	14	11	8	9	10	1	-3	15	15	11	13
NEW YORK TO SYRACUSE																		
15,000	-22	-19	-13	-12	-16	-29	-36	18	17	12	10	14	1	-5	22	21	13	20
10,000	-18	-15	-11	-11	-13	-24	-30	16	13	10	10	12	2	-4	17	17	12	15
5,000	-10	-9	-6	-6	-8	-17	-22	9	8	6	5	7	-2	-7	15	15	11	13
NEW YORK TO TORONTO																		
15,000	-33	-25	-18	-19	-23	-36	-43	30	23	17	18	21	9	3	21	20	13	19
10,000	-25	-19	-14	-16	-18	-28	-34	23	18	14	15	17	7	2	16	17	11	15
5,000	-14	-11	-9	-9	-10	-19	-24	13	10	8	8	10	1	-3	14	14	10	12
NEW YORK TO WASHINGTON, D.C.																		
15,000	-37	-24	-15	-22	-23	-38	-46	35	22	15	21	22	10	3	21	21	12	20
10,000	-26	-18	-12	-17	-17	-28	-35	24	17	11	16	16	6	1	17	17	11	15
5,000	-13	-9	-7	-8	-9	-18	-23	13	9	7	8	9	0	-4	15	14	10	13
NEW YORK TO WILMINGTON, DEL.																		
15,000	-38	-25	-16	-23	-24	-39	-47	36	23	15	22	23	10	3	22	21	13	20
10,000	-26	-19	-12	-17	-18	-29	-35	25	17	12	16	17	6	1	17	18	12	15
5,000	-14	-10	-7	-9	-9	-19	-24	13	9	7	8	9	0	-5	15	15	10	13
NEW YORK TO WORCESTER																		
15,000	29	17	13	18	18	6	-1	-31	-19	-14	-20	-20	-34	-42	22	21	13	20
10,000	19	12	9	13	13	3	-3	-21	-14	-10	-14	-14	-25	-31	18	18	12	15
5,000	10	6	6	7	7	-2	-7	-10	-7	-6	-7	-8	-17	-22	15	15	11	13
NEW YORK TO YOUNGSTOWN																		
15,000	-42	-29	-19	-24	-27	-41	-50	41	28	19	23	26	14	8	21	20	12	19
10,000	-30	-22	-16	-19	-21	-32	-38	30	21	15	19	21	11	5	16	17	11	15
5,000	-16	-12	-9	-10	-12	-20	-25	16	12	9	10	11	3	-2	14	14	10	12
NORFOLK TO PHILADELPHIA																		
15,000	11	4	4	9	6	-5	-11	-16	-7	-5	-11	-9	-21	-28	21	20	12	19
10,000	6	4	2	5	4	-5	-11	-9	-6	-3	-6	-6	-16	-21	17	17	11	15
5,000	3	2	2	2	2	-6	-11	-4	-2	-2	-3	-3	-11	-16	14	14	10	13
NORFOLK TO WASHINGTON, D.C.																		
15,000	-12	-13	-5	-4	-8	-20	-27	8	10	4	2	6	-6	-13	21	20	12	19
10,000	-11	-9	-5	-4	-7	-17	-23	8	7	4	3	5	-4	-10	17	17	11	15
5,000	-5	-5	-3	-2	-4	-12	-17	4	4	3	2	3	-5	-10	14	14	10	13
NORTH BAY TO SUDBURY																		
15,000	-34	-21	-22	-23	-25	-38	-46	33	20	22	22	24	11	4	22	21	15	21
10,000	-25	-15	-16	-18	-18	-29	-35	24	15	16	18	18	7	1	17	18	13	16
5,000	-15	-9	-10	-11	-11	-21	-26	14	9	10	10	11	1	-4	15	16	11	14
NORTH BAY TO TORONTO																		
15,000	-4	1	2	-3	-1	-14	-21	0	-4	-3	0	-2	-14	-21	22	21	14	21
10,000	-3	1	1	-2	0	-11	-17	0	-3	-2	0	-1	-12	-17	17	18	12	16
5,000	-1	1	1	-3	-1	-10	-15	0	-2	-1	2	0	-9	-14	15	16	11	13

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**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*							STANDARD DEVIATION						
	D I R E C T								R E T U R N							JAN	APR	JUL	OCT			
	JAN	APR	JUL	DCT	**A50	A75	A85	JAN	APR	JUL	DCT	A50	A75	A85								
OAKLAND TO RENO																			157 N.MI.			
15,000	12	10	11	8	10	-1	-8	-14	-11	-11	-9	-11	-23	-29	22	19	12	18				
10,000	7	5	7	6	6	-2	-7	-8	-6	-7	-6	-7	-16	-21	16	15	9	13				
5,000	4	4	0	3	3	-3	-7	-5	-4	0	-3	-3	-9	-13	11	9	7	9				
OAKLAND TO SAN FRANCISCO																			9 N.MI.			
15,000	-16	-13	-10	-10	-12	-24	-31	14	12	10	9	11	-1	-7	23	20	12	18				
10,000	-10	-8	-7	-7	-7	-17	-22	9	7	6	6	7	-2	-7	17	15	10	14				
5,000	-5	-4	-2	-2	-3	-10	-13	4	4	2	2	3	-4	-7	12	10	8	10				
OCALA TO VERO BEACH																			130 N.MI.			
15,000	17	15	-1	5	7	-2	-7	-18	-16	1	-5	-8	-20	-26	16	15	9	13				
10,000	8	9	-2	1	3	-5	-9	-9	-9	2	-2	-4	-12	-17	13	13	8	12				
5,000	-3	0	-2	-1	-2	-8	-12	3	-1	2	1	1	-6	-9	11	11	8	11				
OKLAHOMA CITY TO TULSA																			97 N.MI.			
15,000	28	21	7	13	16	4	-1	-30	-22	-8	-14	-17	-30	-39	20	19	11	18				
10,000	20	15	6	9	12	3	-2	-21	-16	-6	-10	-12	-23	-28	15	14	11	14				
5,000	9	9	9	6	8	0	-5	-10	-9	-9	-6	-9	-17	-22	14	15	10	13				
OKLAHOMA CITY TO WICHITA																			135 N.MI.			
15,000	2	2	1	-1	1	-10	-16	-5	-4	-2	0	-3	-14	-20	20	19	11	17				
10,000	2	2	2	0	1	-7	-12	-3	-3	-2	-1	-2	-11	-16	14	14	11	14				
5,000	2	4	6	2	4	-5	-10	-3	-4	-6	-3	-4	-12	-17	14	14	10	12				
OMAHA TO SIOUX CITY																			95 N.MI.			
15,000	0	1	2	-1	1	-11	-18	-3	-3	-3	-1	-3	-14	-21	20	20	13	19				
10,000	-1	-1	1	-2	0	-10	-15	-1	0	-2	0	-1	-10	-15	15	15	12	15				
5,000	-2	0	3	0	0	-8	-13	1	-1	-3	0	-1	-10	-14	14	14	11	13				
ONTARIO TO PALM SPRINGS																			57 N.MI.			
15,000	21	18	6	8	12	1	-4	-22	-19	-6	-9	-13	-25	-32	20	18	11	16				
10,000	12	11	3	5	7	-1	-5	-13	-11	-3	-6	-7	-16	-21	15	13	9	12				
5,000	5	4	3	-2	3	-3	-7	-5	-4	-3	2	-3	-9	-12	10	9	7	8				
ONTARIO TO SAN FRANCISCO																			316 N.MI.			
15,000	-20	-15	-5	-8	-11	-23	-30	19	14	5	7	10	-1	-6	20	18	11	16				
10,000	-13	-11	-2	-5	-7	-16	-21	12	11	1	5	6	-2	-6	15	14	9	12				
5,000	-6	-5	-4	-3	-4	-10	-13	5	5	3	3	4	-2	-5	10	9	7	9				
ORLANDO TO SARASOTA																			94 N.MI.			
15,000	-16	-14	-4	-8	-9	-19	-25	15	12	4	8	9	0	-4	15	15	9	13				
10,000	-11	-9	-4	-6	-7	-15	-20	11	9	4	5	7	-1	-5	13	12	8	11				
5,000	-6	-7	-4	-4	-5	-12	-16	6	7	4	4	5	-2	-5	12	11	8	11				
ORLANDO TO TALLAHASSEE																			193 N.MI.			
15,000	-23	-20	-2	-8	-12	-24	-31	21	19	1	8	11	1	-4	16	16	9	14				
10,000	-13	-12	0	-4	-7	-16	-21	12	11	0	4	6	-2	-6	13	13	9	12				
5,000	-1	-4	0	-2	-2	-9	-13	1	3	0	1	1	-6	-9	12	11	8	11				
ORLANDO TO TAMPA																			72 N.MI.			
15,000	-21	-18	-3	-10	-12	-23	-29	20	17	3	9	11	2	-3	16	15	9	14				
10,000	-14	-12	-3	-6	-8	-17	-21	14	11	3	6	8	0	-4	13	13	8	12				
5,000	-6	-7	-3	-4	-5	-12	-16	5	7	3	3	4	-2	-6	12	11	8	11				
ORLANDO TO WEST PALM BEACH																			130 N.MI.			
15,000	11	11	-3	2	4	-5	-9	-13	-12	3	-2	-5	-15	-21	15	15	8	13				
10,000	4	5	-4	-1	0	-7	-11	-5	-6	4	1	-1	-9	-14	13	12	8	11				
5,000	-6	-2	-4	-4	-4	-10	-14	6	2	4	3	4	-3	-7	11	11	8	10				
OTTAWA TO SYRACUSE																			133 N.MI.			
15,000	-10	-2	-2	-7	-5	-18	-26	6	0	1	5	2	-10	-18	22	22	14	21				
10,000	-5	0	0	-4	-2	-13	-19	3	-1	-1	2	1	-10	-15	17	18	12	16				
5,000	-2	0	-1	-3	-1	-10	-15	1	-1	0	2	1	-8	-13	15	15	11	13				
OTTAWA TO TORONTO																			196 N.MI.			
15,000	-34	-20	-18	-23	-23	-37	-45	32	18	17	21	21	9	2	22	21	14	20				
10,000	-24	-14	-13	-17	-17	-28	-34	23	13	12	16	16	5	0	17	18	12	15				
5,000	-14	-8	-8	-10	-10	-19	-24	13	8	8	10	9	1	-4	15	15	11	13				

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
OTTAWA TO VAL-DOR																		
15,000	-16	-12	-14	-11	-13	-26	-33	12	11	12	9	11	-1	-8	21	20	15	20
10,000	-13	-10	-11	-10	-11	-21	-27	12	9	10	9	10	0	-6	17	17	12	16
5,000	-9	-6	-6	-4	-6	-15	-21	8	5	6	4	6	-4	-9	15	15	11	13
PALM SPRINGS TO SAN DIEGO																		
15,000	-7	-7	-8	-5	-7	-17	-23	5	6	8	5	6	-4	-10	20	17	11	15
10,000	-3	-2	-5	-4	-4	-11	-16	2	1	5	3	3	-5	-10	15	13	9	12
5,000	2	4	-4	4	1	-5	-8	-2	-4	4	-4	-1	-8	-11	10	9	6	8
PANAMA CITY TO PENSACOLA																		
15,000	-29	-24	-4	-12	-16	-30	-37	28	23	4	12	15	4	-1	17	17	10	16
10,000	-19	-15	-2	-7	-10	-20	-26	19	15	2	7	10	1	-4	14	14	10	13
5,000	-8	-7	-3	-4	-5	-13	-17	7	6	2	4	5	-3	-7	13	12	9	12
PANAMA CITY TO TALLAHASSEE																		
15,000	30	24	4	12	16	4	-1	-30	-24	-4	-13	-16	-30	-37	17	17	10	16
10,000	20	16	3	7	11	1	-3	-20	-16	-3	-8	-11	-21	-27	14	14	9	13
5,000	9	8	3	4	6	-2	-6	-9	-8	-4	-4	-6	-14	-18	13	12	9	12
PANAMA CITY TO TAMPA																		
15,000	19	17	1	7	10	0	-5	-20	-18	-1	-8	-10	-22	-29	16	15	9	14
10,000	10	10	-1	4	5	-3	-7	-11	-10	1	-4	-5	-14	-19	13	13	9	12
5,000	0	2	-1	1	0	-7	-10	0	-2	1	-1	-1	-8	-12	12	11	8	11
PHILADELPHIA TO PITTSBURGH																		
15,000	-43	-30	-19	-24	-27	-42	-51	42	29	18	23	26	14	8	21	21	12	19
10,000	-31	-23	-15	-19	-21	-32	-39	30	22	15	19	21	11	5	16	17	11	15
5,000	-16	-13	-9	-10	-11	-20	-25	16	12	8	10	11	3	-2	14	14	10	12
PHILADELPHIA TO RICHMOND																		
15,000	-28	-16	-10	-17	-17	-30	-38	24	14	9	15	15	3	-3	21	21	12	19
10,000	-18	-12	-7	-12	-12	-22	-28	16	11	7	11	11	1	-4	17	17	11	15
5,000	-9	-6	-4	-5	-6	-15	-20	8	6	4	5	6	-3	-7	14	14	10	13
PHILADELPHIA TO ROCHESTER, N.Y.																		
15,000	-20	-18	-11	-10	-14	-27	-34	16	15	10	8	12	0	-7	21	21	13	20
10,000	-16	-13	-10	-9	-12	-22	-28	14	12	9	8	10	0	-5	17	17	12	15
5,000	-9	-8	-6	-5	-7	-15	-20	8	7	5	4	6	-3	-7	15	15	10	12
PHILADELPHIA TO SCRANTON																		
15,000	-9	-11	-6	-3	-7	-20	-27	5	9	4	1	5	-8	-15	22	22	13	20
10,000	-9	-9	-6	-4	-7	-17	-23	6	7	5	3	5	-5	-11	17	18	12	15
5,000	-5	-6	-3	-3	-4	-13	-18	4	5	3	2	3	-6	-10	15	15	10	13
PHILADELPHIA TO SYRACUSE																		
15,000	-8	-10	-5	-3	-6	-19	-26	3	7	4	0	3	-9	-16	21	21	13	20
10,000	-7	-8	-5	-4	-6	-16	-22	5	6	5	2	4	-6	-11	17	17	12	15
5,000	-4	-5	-3	-2	-3	-12	-17	3	4	3	1	3	-6	-11	15	15	10	13
PHILADELPHIA TO WASHINGTON, D.C.																		
15,000	-37	-23	-15	-22	-23	-37	-45	34	21	14	21	21	9	2	21	21	13	20
10,000	-25	-18	-11	-16	-17	-28	-34	24	17	11	15	16	6	0	17	17	12	15
5,000	-13	-9	-7	-8	-9	-18	-23	12	9	6	7	8	0	-5	15	15	10	13
PHILADELPHIA TO WILLIAMSPORT																		
15,000	-29	-23	-14	-15	-19	-33	-41	25	21	13	13	17	5	-2	22	21	13	20
10,000	-22	-18	-12	-13	-16	-27	-33	20	17	12	12	15	4	-1	17	18	12	15
5,000	-11	-10	-7	-7	-9	-18	-23	11	10	7	7	8	0	-5	15	15	10	13
PHILADELPHIA TO YOUNGSTOWN																		
15,000	-41	-29	-18	-23	-26	-41	-49	39	28	18	21	25	13	6	21	21	12	19
10,000	-29	-22	-15	-19	-21	-32	-37	29	21	15	18	20	10	5	16	17	11	15
5,000	-15	-12	-9	-10	-11	-20	-25	15	12	8	9	11	2	-2	14	14	10	12
PHOENIX TO SAN DIEGO																		
15,000	-22	-19	-7	-9	-13	-24	-31	21	18	7	9	12	3	-3	19	16	10	15
10,000	-12	-10	-4	-6	-8	-16	-20	12	10	4	6	7	0	-4	14	12	8	11
5,000	-2	-3	-3	5	-1	-6	-9	2	2	3	-5	1	-5	-8	9	8	6	8

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**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

THE BOEING COMPANY
TRANSPORT DIVISION

NO. 06-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	D I R E C T								R E T U R N													
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
PHOENIX TO TUCSON																			96 N.MI.			
15,000	13	10	-4	4	4	-6	-11	-15	-11	3	-4	-5	-17	-24	19	16	10	15				
10,000	8	6	-2	1	3	-5	-9	-9	-7	2	-1	-3	-11	-16	14	11	9	11				
5,000	-5	-5	-4	-3	-4	-9	-12	4	4	4	3	4	-1	-3	9	8	5	8				
PIERRE TO RAPID CITY																			121 N.MI.			
15,000	-26	-17	-19	-24	-21	-33	-40	25	17	19	23	21	9	3	19	19	13	18				
10,000	-19	-11	-12	-14	-14	-23	-28	18	10	12	13	13	4	0	14	14	11	14				
5,000	-11	-6	-5	-8	-8	-16	-21	11	5	5	8	7	-1	-6	13	13	12	13				
PIERRE TO SIOUX FALLS																			160 N.MI.			
15,000	28	19	18	24	22	11	4	-29	-20	-19	-25	-23	-35	-42	19	19	13	18				
10,000	22	13	13	16	16	6	1	-22	-14	-14	-16	-16	-26	-31	14	15	12	14				
5,000	12	6	5	10	8	-1	-6	-12	-7	-5	-10	-9	-18	-23	13	14	12	14				
PITTSBURGH TO RALEIGH																			285 N.MI.			
15,000	5	9	3	0	4	-7	-14	-10	-11	-4	-2	-6	-18	-25	20	20	11	19				
10,000	6	6	4	2	5	-5	-10	-8	-8	-5	-4	-6	-15	-21	15	16	11	14				
5,000	3	4	3	2	3	-5	-10	-4	-4	-3	-2	-3	-11	-16	14	13	9	12				
PITTSBURGH TO ROANOKE																			190 N.MI.			
15,000	-2	4	1	-4	0	-12	-19	-4	-7	-1	2	-2	-14	-21	21	21	12	19				
10,000	1	3	2	0	2	-8	-14	-3	-5	-3	-1	-3	-13	-18	16	17	11	15				
5,000	0	2	2	0	1	-7	-12	-1	-3	-2	-1	-2	-10	-14	14	14	9	12				
PITTSBURGH TO TOLEDO																			175 N.MI.			
15,000	-39	-27	-18	-22	-25	-40	-48	38	26	17	21	24	12	5	21	21	13	20				
10,000	-28	-20	-15	-18	-20	-31	-36	27	20	14	17	19	9	3	16	17	12	15				
5,000	-15	-11	-8	-10	-11	-19	-24	14	11	8	9	10	2	-3	15	15	10	13				
PITTSBURGH TO WASHINGTON, D.C.																			177 N.MI.			
15,000	34	26	14	17	21	9	3	-36	-27	-15	-18	-23	-37	-45	21	21	12	20				
10,000	25	20	13	15	18	8	2	-26	-21	-14	-16	-18	-29	-35	16	17	11	15				
5,000	13	11	7	8	9	1	-3	-14	-11	-7	-8	-10	-19	-23	14	14	10	12				
PITTSBURGH TO WILLIAMSPORT																			156 N.MI.			
15,000	40	25	18	24	25	13	6	-42	-26	-18	-25	-26	-41	-50	21	21	13	20				
10,000	29	19	14	19	19	9	3	-29	-20	-14	-19	-20	-31	-37	17	17	12	15				
5,000	15	10	8	10	10	2	-3	-16	-11	-8	-10	-11	-20	-25	15	15	10	13				
PITTSBURGH TO YOUNGSTOWN																			52 N.MI.			
15,000	-20	-17	-9	-8	-13	-26	-34	15	14	8	6	10	-2	-9	22	22	13	20				
10,000	-14	-12	-9	-9	-11	-21	-27	11	11	8	7	9	-1	-7	17	18	12	16				
5,000	-7	-7	-5	-4	-6	-14	-19	6	6	4	4	5	-4	-8	15	15	10	13				
POCATELLO TO SALT LAKE CITY																			131 N.MI.			
15,000	9	4	-1	5	4	-7	-13	-11	-5	1	-6	-5	-17	-23	19	17	12	17				
10,000	6	2	-2	3	2	-6	-10	-7	-3	1	-3	-3	-11	-15	13	12	10	11				
5,000	-8	-4	-4	-5	-5	-11	-14	8	4	4	5	5	0	-3	9	8	6	8				
PORTLAND, ME. TO WATERVILLE																			60 N.MI.			
15,000	21	11	10	15	14	0	-7	-24	-13	-11	-17	-16	-30	-38	23	22	15	21				
10,000	12	6	5	9	8	-3	-9	-14	-7	-6	-10	-9	-20	-26	18	18	12	16				
5,000	5	3	5	5	4	-5	-10	-6	-4	-6	-6	-5	-15	-20	16	15	12	13				
PORTLAND, ORE. TO RENO																			386 N.MI.			
15,000	11	6	2	5	5	-6	-12	-13	-7	-3	-6	-6	-18	-25	20	19	12	18				
10,000	6	3	0	3	3	-6	-10	-7	-4	-1	-4	-3	-12	-17	15	14	10	13				
5,000	-2	-1	4	-2	0	-6	-10	2	1	-4	1	0	-6	-10	11	9	7	9				
PORTLAND, ORE. TO SALEM																			43 N.MI.			
15,000	-9	-8	-7	-10	-8	-21	-28	6	7	6	8	7	-6	-13	22	21	14	20				
10,000	-9	-8	-4	-6	-7	-16	-22	8	7	4	6	6	-4	-9	17	15	11	15				
5,000	-7	-5	2	-6	-3	-11	-15	7	4	-3	5	3	-4	-8	13	11	8	11				
PORTLAND, ORE. TO SEATTLE																			113 N.MI.			
15,000	-2	2	2	2	1	-11	-18	-1	-4	-3	-4	-3	-15	-22	22	20	14	19				
10,000	2	4	1	2	2	-7	-12	-4	-4	-2	-3	-3	-12	-17	16	14	11	14				
5,000	6	4	-2	5	3	-5	-8	-6	-4	2	-5	-3	-11	-15	13	11	8	11				

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
PORTLAND, ORE. TO SPOKANE																		
15,000	19	14	14	18	16	4	-2	-20	-15	-14	-19	-17	-29	-35	20	19	13	18
10,000	15	11	7	11	11	2	-2	-16	-12	-8	-11	-11	-21	-26	15	13	10	13
5,000	9	6	1	6	5	-2	-5	-9	-6	-1	-6	-5	-12	-16	12	10	8	10
PORTLAND, ORE. TO YAKIMA																		
15,000	18	14	13	17	15	3	-4	-20	-15	-14	-19	-16	-29	-36	21	20	14	19
10,000	15	12	7	11	11	2	-3	-16	-12	-7	-11	-11	-21	-26	16	14	11	14
5,000	8	6	0	6	4	-2	-6	-8	-6	0	-6	-5	-12	-16	13	10	8	11
PRINCE GEORGE TO QUESNEL																		
15,000	4	-1	1	-1	1	-11	-17	-5	0	-2	-1	-2	-13	-20	20	18	15	17
10,000	1	-2	1	-1	0	-9	-14	-3	1	-2	0	-1	-10	-14	16	13	11	13
5,000	-5	-6	-1	-4	-4	-12	-17	5	5	1	4	4	-4	-9	14	12	10	13
PRINCE GEORGE TO SMITHERS																		
15,000	-20	-11	-8	-16	-13	-25	-32	18	10	7	16	12	1	-5	20	17	14	17
10,000	-14	-8	-7	-13	-10	-20	-25	14	8	7	12	10	1	-4	16	13	11	13
5,000	-5	-1	-3	-5	-3	-11	-15	4	0	3	4	3	-5	-9	14	12	10	12
PRINCE GEORGE TO VANCOUVER																		
15,000	-1	-4	-2	-4	-3	-14	-20	-1	2	1	3	1	-10	-17	20	18	14	17
10,000	-3	-4	-1	-4	-3	-12	-16	2	4	0	3	2	-7	-11	16	13	11	13
5,000	-7	-6	-2	-6	-5	-13	-17	6	6	2	6	5	-3	-7	13	11	9	12
PRINCE RUPERT TO SANDSPIT																		
15,000	-15	-15	-4	-18	-13	-27	-34	14	14	4	17	12	-1	-8	23	19	16	19
10,000	-13	-12	-6	-16	-12	-22	-28	13	12	6	16	11	1	-4	18	15	12	14
5,000	-9	-8	-5	-9	-8	-16	-21	8	8	5	9	7	-1	-6	15	12	10	13
PRINCE RUPERT TO TERRACE																		
15,000	18	13	6	17	13	0	-6	-20	-14	-6	-18	-14	-27	-34	22	19	15	18
10,000	14	9	7	14	11	1	-4	-15	-10	-8	-15	-11	-21	-27	18	14	11	14
5,000	6	3	4	5	5	-4	-8	-6	-3	-5	-6	-5	-13	-18	15	12	10	13
PROVIDENCE TO WASHINGTON, D.C.																		
15,000	-37	-24	-16	-23	-24	-38	-46	36	23	16	22	23	10	4	21	20	12	19
10,000	-26	-18	-12	-17	-18	-28	-34	25	17	12	16	17	7	2	17	17	11	15
5,000	-13	-10	-7	-9	-10	-18	-23	13	9	7	8	9	1	-4	14	14	10	12
PUEBLO TO SANTA FE																		
15,000	-11	-9	-8	-5	-8	-19	-25	8	8	8	4	7	-3	-9	19	17	11	16
10,000	-6	-6	-5	-4	-5	-13	-17	5	5	5	4	5	-3	-8	14	12	10	12
5,000	-6	-7	-7	-6	-7	-13	-16	6	6	7	6	6	0	-3	10	10	7	9
QUEBEC TO SAGUENAY																		
15,000	8	2	0	4	3	-10	-17	-11	-3	-2	-7	-5	-19	-26	22	21	16	21
10,000	2	-1	-1	2	0	-10	-15	-4	0	0	-3	-2	-12	-18	18	16	13	16
5,000	-1	-1	1	3	1	-9	-14	0	0	-2	-4	-1	-11	-16	16	15	12	14
QUEBEC TO SEVEN ISLANDS																		
15,000	24	12	13	17	16	4	-3	-25	-13	-15	-19	-18	-31	-38	21	20	15	20
10,000	15	6	9	13	10	1	-5	-17	-7	-10	-14	-11	-22	-28	17	14	13	16
5,000	8	4	8	10	7	-2	-7	-9	-5	-8	-11	-8	-17	-23	15	15	12	14
QUESNEL TO WILLIAM LAKE																		
15,000	8	2	3	3	4	-8	-14	-10	-3	-3	-5	-5	-17	-24	20	18	15	18
10,000	4	1	3	2	2	-7	-11	-6	-1	-3	-3	-3	-12	-17	16	13	11	13
5,000	-3	-5	-1	-3	-3	-11	-15	3	4	0	3	2	-5	-10	13	12	10	12
RALEIGH TO RICHMOND																		
15,000	25	15	8	14	14	3	-3	-28	-18	-8	-15	-16	-29	-37	20	20	12	19
10,000	16	12	6	10	10	1	-4	-18	-13	-7	-11	-12	-22	-28	16	16	11	15
5,000	9	6	3	4	5	-3	-7	-9	-7	-4	-4	-6	-14	-19	14	13	9	13
RALEIGH TO WASHINGTON, D.C.																		
15,000	18	9	6	12	10	-1	-7	-22	-12	-7	-13	-12	-25	-33	20	20	12	19
10,000	11	8	4	8	7	-2	-7	-13	-9	-5	-9	-9	-19	-24	16	16	11	15
5,000	6	4	2	3	4	-4	-9	-7	-5	-3	-4	-4	-13	-17	14	13	9	12

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**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	DIRECT								RETURN											
	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
READING TO SYRACUSE																				
15,000	-1	-5	-2	1	-2	-14	-21	-4	3	1	-4	-1	-13	-21	22	21	13	20		
10,000	-3	-4	-3	-1	-3	-13	-19	0	3	2	-1	1	-9	-15	17	17	12	15		
5,000	-2	-3	-2	0	-2	-10	-15	0	2	1	0	1	-8	-13	15	15	10	13		
REGINA TO SWIFT CURRENT																				
15,000	-25	-16	-19	-19	-20	-30	-36	24	15	18	19	19	8	2	17	16	14	17		
10,000	-19	-10	-12	-16	-14	-23	-27	19	10	12	15	14	5	1	13	13	11	13		
5,000	-13	-4	-5	-9	-8	-17	-22	13	4	4	9	7	-2	-6	14	13	12	13		
REGINA TO WINNIPEG																				
15,000	26	16	19	20	20	10	4	-26	-17	-20	-21	-21	-32	-37	17	16	13	16		
10,000	20	10	14	16	15	7	2	-20	-11	-15	-17	-16	-24	-29	13	13	11	13		
5,000	10	3	5	10	7	-2	-7	-11	-3	-5	-10	-7	-16	-21	14	13	12	14		
REGINA TO YORKTON																				
15,000	15	11	15	12	13	3	-3	-17	-12	-16	-14	-15	-25	-31	17	16	14	17		
10,000	12	6	10	10	9	1	-4	-13	-6	-10	-11	-10	-19	-23	13	13	11	13		
5,000	8	2	4	7	5	-4	-9	-9	-3	-4	-7	-6	-15	-20	14	14	12	14		
RENO TO SACRAMENTO																				
15,000	-15	-11	-12	-10	-12	-24	-31	13	10	12	9	11	-1	-7	22	19	12	18		
10,000	-10	-7	-7	-7	-8	-16	-22	9	6	7	6	7	-2	-7	16	15	10	14		
5,000	-5	-5	0	-4	-3	-10	-13	5	5	0	4	3	-3	-6	11	9	7	9		
RENO TO SALT LAKE CITY																				
15,000	20	15	14	13	15	5	-1	-21	-16	-14	-14	-16	-27	-33	20	17	11	17		
10,000	13	9	8	9	9	2	-2	-13	-9	-8	-9	-10	-18	-22	14	12	9	12		
5,000	2	3	0	3	2	-3	-6	-2	-3	0	-3	-2	-7	-10	9	8	6	7		
RENO TO SAN FRANCISCO																				
15,000	-14	-11	-11	-9	-11	-23	-29	12	10	11	8	10	-1	-8	22	19	12	18		
10,000	-8	-6	-7	-6	-7	-16	-21	8	5	7	6	6	-2	-7	16	15	9	13		
5,000	-5	-4	-1	-3	-3	-9	-13	4	4	0	3	3	-3	-7	11	9	7	9		
RICHMOND TO WASHINGTON, D.C.																				
15,000	8	1	2	7	4	-8	-14	-12	-4	-3	-9	-7	-19	-26	21	21	12	20		
10,000	4	1	1	4	2	-8	-13	-6	-3	-2	-5	-4	-14	-20	17	17	11	15		
5,000	2	0	1	1	1	-7	-12	-3	-1	-1	-2	-2	-10	-15	15	14	10	13		
ROANOKE TO WASHINGTON, D.C.																				
15,000	35	22	13	20	21	9	3	-37	-24	-13	-21	-22	-37	-45	20	20	12	19		
10,000	24	17	10	15	16	6	1	-25	-18	-10	-15	-16	-27	-33	16	17	11	15		
5,000	13	9	6	7	8	0	-5	-13	-10	-6	-7	-9	-17	-22	14	14	9	12		
ROANOKE TO WINSTON-SALEM																				
15,000	-13	-5	-2	-8	-6	-19	-26	9	2	2	6	4	-7	-14	20	20	12	19		
10,000	-6	-3	-1	-5	-4	-13	-19	4	1	1	4	2	-7	-12	16	17	11	15		
5,000	-3	-2	0	-1	-1	-10	-14	2	1	0	1	1	-7	-12	14	13	9	13		
ROCHESTER, MINN. TO WATERLOO																				
15,000	4	3	2	4	3	-9	-15	-8	-5	-3	-6	-5	-18	-25	20	20	14	20		
10,000	4	3	2	3	3	-7	-12	-6	-4	-3	-4	-4	-14	-20	15	16	13	15		
5,000	3	3	0	1	1	-8	-13	-4	-3	0	-2	-2	-11	-16	14	15	12	14		
ROCHESTER, N.Y. TO SYRACUSE																				
15,000	38	25	21	24	26	13	6	-40	-26	-21	-25	-27	-41	-49	22	22	14	21		
10,000	28	19	16	19	20	9	3	-29	-19	-16	-20	-20	-32	-38	17	18	12	16		
5,000	16	11	10	11	11	2	-3	-16	-11	-10	-11	-12	-21	-26	15	15	11	13		
ROCHESTER, N.Y. TO WASHINGTON, D.C.																				
15,000	0	5	2	-2	1	-11	-18	-5	-8	-3	0	-4	-16	-23	21	21	13	19		
10,000	2	4	3	1	3	-7	-13	-5	-6	-4	-2	-4	-14	-20	16	17	11	15		
5,000	1	3	2	1	2	-7	-11	-2	-4	-2	-1	-2	-11	-15	14	14	10	12		
ROUYN-NORANDA TO VAL-D'OR																				
15,000	30	17	22	22	23	10	3	-31	-18	-22	-23	-24	-37	-44	21	20	15	20		
10,000	22	12	16	18	17	6	1	-23	-13	-16	-18	-17	-28	-34	17	17	13	16		
5,000	14	8	10	11	11	1	-4	-14	-8	-11	-12	-11	-21	-26	15	16	12	14		

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION							
	D I R E C T							R E T U R N														
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
SACRAMENTO TO SAN FRANCISCO																			73 N.MI.			
15,000	-12	-10	-10	-9	-10	-22	-28	10	9	9	8	9	-3	-9	22	19	12	18				
10,000	-7	-5	-6	-6	-6	-15	-20	6	5	6	5	5	-3	-9	17	15	10	14				
5,000	-4	-4	-1	-2	-2	-9	-12	4	3	0	1	2	-4	-8	12	10	7	10				
SACRAMENTO TO STOCKTON																			37 N.MI.			
15,000	6	3	-2	0	1	-10	-17	-8	-5	1	-2	-2	-15	-22	22	20	12	18				
10,000	5	4	-3	0	1	-8	-13	-6	-4	2	-1	-2	-11	-17	17	15	10	14				
5,000	0	0	3	2	1	-5	-9	0	0	-3	-2	-2	-8	-11	12	10	7	9				
SAGUENAY TO SEVEN ISLANDS																			207 N.MI.			
15,000	27	13	18	21	19	6	-1	-26	-14	-19	-22	-20	-34	-41	21	20	16	20				
10,000	18	8	12	16	13	3	-3	-19	-8	-13	-17	-14	-25	-30	17	14	13	16				
5,000	11	5	9	12	9	0	-5	-11	-6	-10	-13	-10	-20	-25	16	15	12	14				
ST. JOHN TO YARMOUTH																			89 N.MI.			
15,000	-11	-5	-3	-8	-7	-21	-29	8	3	1	6	4	-9	-17	23	23	15	21				
10,000	-6	-2	-1	-3	-3	-14	-20	3	1	0	1	1	-10	-16	19	18	13	16				
5,000	-1	0	-2	-2	-1	-11	-16	-1	0	2	1	1	-9	-14	16	16	12	13				
ST. JOHNS TO SYDNEY																			312 N.MI.			
15,000	-34	-21	-22	-28	-26	-40	-48	33	20	21	26	25	11	4	23	22	15	20				
10,000	-26	-15	-18	-20	-19	-31	-37	25	14	17	20	19	8	2	19	18	13	17				
5,000	-14	-9	-13	-14	-12	-22	-28	14	8	13	13	12	2	-3	17	16	13	13				
ST. LOUIS TO SPRINGFIELD, MO.																			169 N.MI.			
15,000	-32	-22	-11	-16	-19	-33	-40	31	21	11	15	18	6	0	20	20	12	19				
10,000	-23	-16	-9	-12	-15	-25	-31	22	15	9	11	14	4	-1	15	15	11	15				
5,000	-12	-9	-7	-7	-9	-17	-22	11	9	7	7	8	0	-5	14	15	10	13				
ST. LOUIS TO TULSA																			304 N.MI.			
15,000	-32	-22	-11	-16	-19	-32	-40	30	21	10	15	18	6	0	19	19	11	18				
10,000	-23	-16	-9	-12	-14	-24	-30	22	15	8	11	14	4	-1	14	15	11	14				
5,000	-11	-9	-7	-7	-9	-17	-22	11	9	7	7	8	0	-4	14	14	10	12				
SALINAS TO SAN FRANCISCO																			69 N.MI.			
15,000	-17	-12	-4	-6	-9	-22	-29	15	11	4	6	8	-3	-9	22	19	12	18				
10,000	-12	-9	-1	-4	-6	-16	-21	11	9	1	4	5	-3	-8	17	15	10	13				
5,000	-4	-4	-4	-5	-4	-11	-14	4	4	4	4	4	-2	-6	12	10	8	10				
SALINAS TO SANTA BARBARA																			159 N.MI.			
15,000	16	11	2	5	8	-3	-9	-17	-13	-3	-6	-8	-21	-28	21	18	11	17				
10,000	11	10	0	3	5	-4	-8	-11	-10	0	-4	-5	-15	-21	16	14	9	13				
5,000	5	5	3	4	4	-2	-5	-5	-5	-3	-4	-4	-11	-14	11	10	7	9				
SAN DIEGO TO SAN FRANCISCO																			389 N.MI.			
15,000	-18	-14	-3	-6	-9	-21	-28	17	13	3	6	8	-2	-7	20	17	10	15				
10,000	-12	-11	-1	-4	-6	-15	-20	11	10	0	4	5	-3	-7	15	13	8	12				
5,000	-5	-5	-3	-3	-4	-10	-13	5	5	3	3	4	-2	-5	10	9	7	8				
SAN FRANCISCO TO STOCKTON																			56 N.MI.			
15,000	18	15	11	11	13	2	-5	-20	-16	-11	-11	-14	-26	-33	22	19	12	18				
10,000	11	9	7	7	8	-1	-5	-12	-9	-7	-8	-9	-18	-23	17	15	10	14				
5,000	5	5	3	3	4	-3	-6	-6	-5	-3	-3	-4	-10	-14	12	10	7	10				
SARASOTA TO TAMPA																			34 N.MI.			
15,000	0	-1	4	2	2	-7	-12	-2	0	-4	-3	-3	-11	-16	16	15	9	13				
10,000	3	1	5	3	3	-5	-9	-4	-2	-5	-3	-3	-11	-15	13	12	8	11				
5,000	7	5	5	4	5	-2	-5	-7	-5	-5	-4	-5	-12	-16	12	11	8	11				
SARASOTA TO WEST PALM BEACH																			138 N.MI.			
15,000	19	18	-1	6	9	-1	-5	-20	-18	1	-6	-9	-21	-27	15	14	8	12				
10,000	9	10	-2	2	4	-4	-7	-10	-10	2	-3	-4	-13	-18	12	12	8	11				
5,000	-3	1	-2	-2	-1	-8	-12	3	-2	2	1	1	-5	-9	11	11	7	10				
SASKATOON TO WINNIPEG																			381 N.MI.			
15,000	26	16	18	20	20	10	4	-27	-17	-18	-21	-20	-31	-37	16	15	13	16				
10,000	20	11	14	16	15	7	2	-20	-11	-14	-17	-16	-24	-29	12	12	11	12				
5,000	10	3	4	10	7	-2	-7	-11	-3	-5	-10	-7	-16	-21	13	13	11	13				

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.THE BDEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
SAULT STE. MARIE TO TORONTO																				
15,000	27	19	18	18	20	8	1	-30	-20	-19	-19	-22	-34	-42	21	20	14	20		
10,000	20	14	14	14	15	5	0	-22	-15	-14	-15	-16	-27	-32	16	17	12	15		
5,000	12	8	8	7	9	0	-5	-13	-9	-8	-8	-9	-18	-23	14	15	11	13		
266 N.MI.																				
SCRANTON TO SYRACUSE																				
15,000	-6	-8	-5	-2	-5	-18	-25	1	6	4	0	2	-10	-18	22	22	14	21		
10,000	-6	-7	-5	-3	-5	-15	-21	3	5	4	2	4	-7	-13	17	18	12	16		
5,000	-4	-4	-3	-1	-3	-12	-17	2	3	2	1	2	-7	-12	15	15	11	13		
99 N.MI.																				
SCRANTON TO WILLIAMSPORT																				
15,000	-41	-27	-19	-25	-27	-42	-50	40	25	19	24	26	12	6	22	22	13	21		
10,000	-29	-20	-15	-19	-20	-32	-38	28	19	14	18	19	9	3	17	18	12	16		
5,000	-15	-11	-9	-10	-11	-20	-26	15	10	8	10	11	2	-3	15	15	11	13		
54 N.MI.																				
SEATTLE TO SPOKANE																				
15,000	24	16	14	21	18	6	0	-25	-16	-15	-21	-19	-31	-38	20	19	14	18		
10,000	18	12	8	13	12	3	-1	-18	-13	-8	-13	-13	-22	-27	15	13	11	13		
5,000	8	5	3	5	5	-2	-5	-8	-5	-3	-5	-5	-12	-16	12	10	8	11		
190 N.MI.																				
SEATTLE TO VANCOUVER																				
15,000	-11	-5	-4	-6	-6	-19	-26	9	3	3	4	5	-8	-15	21	20	15	19		
10,000	-5	-1	-3	-3	-3	-12	-17	4	1	2	2	2	-7	-12	17	14	11	14		
5,000	2	3	-2	3	1	-6	-10	-3	-3	2	-3	-2	-9	-14	13	11	9	12		
109 N.MI.																				
SEATTLE TO VICTORIA																				
15,000	-16	-9	-7	-10	-10	-23	-31	14	7	6	9	9	-4	-11	22	20	15	19		
10,000	-9	-5	-5	-6	-6	-15	-21	8	4	4	5	5	-4	-9	17	14	11	14		
5,000	0	1	-3	1	0	-8	-12	-1	-1	3	-2	0	-8	-12	13	11	9	12		
85 N.MI.																				
SEATTLE TO YAKIMA																				
15,000	22	13	11	16	15	2	-4	-23	-14	-11	-17	-16	-29	-36	21	20	14	19		
10,000	14	8	6	10	9	0	-5	-15	-9	-6	-10	-10	-19	-25	16	14	11	14		
5,000	2	2	4	1	2	-5	-9	-3	-3	-4	-1	-3	-10	-13	13	11	8	11		
90 N.MI.																				
SHREVEPORT TO TEXARKANA																				
15,000	-2	-4	-1	-3	-2	-13	-19	-1	2	0	2	1	-10	-16	19	18	11	17		
10,000	-1	-1	2	-2	0	-9	-14	-1	0	-2	1	-1	-9	-14	14	14	10	14		
5,000	2	3	4	1	2	-6	-11	-3	-3	-4	-1	-3	-11	-16	14	14	10	12		
61 N.MI.																				
SHREVEPORT TO TULSA																				
15,000	-12	-11	-3	-8	-8	-19	-25	9	9	2	7	6	-4	-9	19	18	11	17		
10,000	-8	-6	-1	-5	-5	-13	-18	7	5	1	4	4	-5	-9	14	14	10	13		
5,000	-2	-1	1	-1	0	-8	-13	1	0	-2	1	0	-8	-13	14	14	9	12		
247 N.MI.																				
SIOUX CITY TO SIOUX FALLS																				
15,000	-12	-9	-5	-10	-9	-21	-28	10	7	4	8	7	-5	-11	20	20	13	19		
10,000	-10	-8	-5	-8	-7	-17	-23	9	7	4	7	6	-3	-8	15	15	12	15		
5,000	-7	-4	-1	-5	-4	-13	-18	6	3	0	4	3	-6	-11	14	15	12	14		
73 N.MI.																				
SIOUX CITY TO WATERLOO																				
15,000	31	21	18	22	22	11	4	-32	-22	-19	-23	-23	-36	-43	20	20	13	19		
10,000	23	15	13	15	16	7	1	-24	-16	-13	-16	-17	-27	-32	15	15	12	15		
5,000	12	7	7	10	9	0	-5	-12	-8	-7	-10	-9	-18	-23	14	15	11	13		
177 N.MI.																				
SMITHERS TO TERRACE																				
15,000	-19	-14	-6	-19	-14	-27	-34	18	13	5	18	13	1	-6	22	18	15	18		
10,000	-15	-11	-7	-16	-12	-22	-27	14	10	7	16	11	2	-3	17	14	11	14		
5,000	-8	-5	-5	-8	-6	-14	-19	7	5	5	7	6	-2	-7	14	12	10	13		
53 N.MI.																				
SPOKANE TO YAKIMA																				
15,000	-20	-14	-14	-19	-17	-29	-36	19	13	14	18	16	4	-2	20	19	14	18		
10,000	-16	-12	-8	-12	-11	-21	-26	15	11	7	11	11	2	-2	15	13	11	13		
5,000	-10	-6	-2	-6	-6	-13	-17	9	6	2	6	5	-2	-5	12	10	8	11		
135 N.MI.																				
STEPHENVILLE TO SYDNEY																				
15,000	-19	-13	-10	-16	-14	-28	-36	16	11	8	14	12	-2	-9	23	23	16	21		
10,000	-14	-8	-7	-9	-9	-21	-27	12	7	6	7	8	-3	-9	19	18	14	17		
5,000	-6	-4	-6	-6	-6	-16	-21	5	4	6	5	5	-5	-11	17	16	13	14		
155 N.MI.																				

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**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTE

HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION				
	D I R E C T							R E T U R N											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT	
SUDBURY TO TIMMINS																			
15,000	-8	-8	-9	-6	-8	-20	-27	5	6	7	4	6	-7	-14	21	20	119 N.M.I.	14	20
10,000	-8	-6	-7	-6	-7	-17	-23	6	5	7	5	6	-5	-10	16	17	13	15	15
5,000	-5	-4	-3	-1	-3	-12	-17	4	3	2	0	2	-7	-12	15	15	11	14	14
SUDBURY TO TORONTO																			
15,000	8	9	9	5	8	-5	-12	-12	-11	-10	-8	-10	-23	-30	22	21	183 N.M.I.	14	20
10,000	6	7	7	5	6	-4	-10	-9	-8	-7	-6	-7	-18	-23	17	18	12	16	16
5,000	4	4	4	1	3	-6	-11	-5	-5	-4	-1	-4	-13	-18	15	16	11	13	13
SYRACUSE TO WASHINGTON, D.C.																			
15,000	-11	-3	-3	-9	-6	-19	-26	7	0	2	7	4	-8	-15	21	21	259 N.M.I.	13	19
10,000	-6	-2	-1	-5	-3	-13	-19	4	0	0	3	2	-8	-14	17	17	11	15	15
5,000	-3	0	-1	-2	-1	-10	-15	2	-1	0	2	1	-8	-12	14	14	10	12	12
TALLAHASSEE TO TAMPA																			
15,000	13	12	0	4	6	-3	-8	-14	-13	0	-5	-7	-18	-24	16	16	174 N.M.I.	9	14
10,000	6	6	-2	2	2	-5	-10	-7	-7	2	-2	-3	-12	-16	13	13	9	12	12
5,000	-3	0	-2	-1	-1	-8	-12	2	0	2	0	1	-6	-10	12	11	8	11	11
TEMPLE TO WACO																			
15,000	13	9	4	3	7	-3	-9	-15	-11	-4	-4	-8	-19	-25	18	17	30 N.M.I.	11	16
10,000	10	8	4	3	6	-2	-7	-12	-9	-5	-3	-7	-15	-20	14	13	10	13	13
5,000	7	8	9	4	7	-1	-5	-8	-8	-9	-5	-8	-16	-20	14	13	9	12	12
TERRACE TO VANCOUVER																			
15,000	11	4	6	6	6	-5	-12	-12	-5	-6	-7	-8	-19	-26	20	18	375 N.M.I.	14	17
10,000	6	1	4	3	4	-5	-10	-7	-2	-5	-4	-4	-13	-18	16	13	11	13	13
5,000	-1	-4	0	-2	-2	-9	-13	0	3	-1	2	1	-6	-10	13	11	9	12	12
TOLEDO TO WASHINGTON, D.C.																			
15,000	36	26	16	19	23	11	5	-38	-27	-16	-20	-24	-38	-46	20	20	351 N.M.I.	12	19
10,000	26	20	14	16	18	9	4	-27	-21	-14	-17	-19	-30	-35	16	16	11	14	14
5,000	14	11	7	8	10	2	-3	-14	-11	-8	-9	-10	-19	-23	14	14	9	12	12
TORONTO TO WASHINGTON, D.C.																			
15,000	12	13	7	5	9	-3	-9	-17	-15	-9	-7	-11	-24	-31	21	20	313 N.M.I.	12	19
10,000	10	10	7	6	8	-1	-7	-12	-11	-8	-7	-10	-20	-25	16	17	11	15	15
5,000	6	6	4	3	5	-4	-8	-7	-7	-5	-4	-5	-14	-18	14	14	10	12	12
TORONTO TO WINOSOR																			
15,000	-26	-19	-17	-17	-20	-33	-40	24	17	17	15	18	6	-1	21	21	210 N.M.I.	14	20
10,000	-19	-14	-13	-13	-15	-25	-31	18	13	12	13	14	4	-2	16	17	12	15	15
5,000	-11	-8	-8	-7	-8	-17	-22	10	8	7	6	8	-1	-6	15	15	11	13	13
TULSA TO WICHITA																			
15,000	-21	-16	-7	-13	-13	-26	-33	19	14	6	12	12	1	-5	20	19	109 N.M.I.	12	18
10,000	-15	-10	-4	-9	-9	-19	-24	14	9	4	8	8	-1	-6	15	15	11	14	14
5,000	-6	-3	-1	-4	-3	-12	-17	5	3	1	3	3	-6	-10	14	14	10	13	13
WASHINGTON, D.C. TO WILMINGTON, DEL.																			
15,000	34	21	14	21	21	9	2	-37	-23	-14	-22	-23	-37	-45	21	21	83 N.M.I.	13	20
10,000	24	17	11	15	16	6	0	-25	-18	-11	-16	-17	-28	-34	17	17	12	15	15
5,000	12	9	6	7	8	0	-5	-13	-9	-6	-8	-9	-18	-23	15	15	10	13	13

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

TABLE 4
EQUIVALENT WINDS AT THE 20,000-, 30,000-, 40,000-
AND 53,000-FOOT LEVELS FOR ROUTES $\geq$ 200 NAUTICAL
MILES IN LENGTH

TABLE 4. EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	DIRECT								RETURN													
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
ABILENE TO EL PASO																			342 N.MI.			
53,000	-44	-36	0	-19	-24	-41	-49	43	35	-1	19	24	7	-1	18	16	12	16				
40,000	-68	-59	-14	-43	-45	-68	-81	66	57	13	41	44	21	11	29	26	20	24				
30,000	-57	-48	-9	-32	-35	-57	-69	55	47	9	31	33	13	5	29	25	15	23				
20,000	-35	-29	-4	-16	-19	-35	-43	34	29	4	15	19	5	0	20	17	10	17				
ABILENE TO HOUSTON																			281 N.MI.			
53,000	32	26	-2	14	17	3	-3	-35	-28	1	-15	-19	-34	-42	17	16	11	16				
40,000	46	41	8	34	32	12	2	-54	-47	-9	-37	-36	-57	-68	28	27	20	23				
30,000	38	33	6	26	24	7	-1	-44	-38	-6	-28	-27	-47	-58	27	25	15	24				
20,000	25	21	-3	13	13	0	-6	-28	-23	2	-14	-14	-29	-37	19	17	10	17				
AKRON TO CHICAGO																			297 N.MI.			
53,000	-44	-29	-13	-28	-27	-41	-49	43	29	13	27	27	14	8	18	16	12	15				
40,000	-72	-48	-39	-49	-51	-72	-83	70	46	38	46	49	30	20	29	27	24	29				
30,000	-68	-45	-32	-44	-45	-67	-79	65	42	31	41	44	24	15	30	29	20	30				
20,000	-46	-30	-22	-30	-30	-46	-55	45	29	21	28	29	16	9	23	23	14	22				
AKRON TO NEW YORK																			349 N.MI.			
53,000	47	30	12	29	28	15	9	-48	-31	-12	-29	-29	-44	-52	18	17	12	16				
40,000	75	49	37	50	52	32	21	-77	-52	-38	-52	-54	-75	-87	29	28	24	28				
30,000	71	46	32	44	46	27	17	-74	-48	-33	-47	-48	-70	-83	29	30	20	29				
20,000	49	32	22	30	31	17	11	-50	-33	-22	-31	-32	-49	-59	23	23	13	22				
AKRON TO WASHINGTON, D. C.																			238 N.MI.			
53,000	37	27	11	22	23	11	5	-40	-28	-12	-23	-25	-38	-46	19	17	13	16				
40,000	64	42	33	37	43	23	13	-70	-46	-34	-41	-47	-68	-80	29	29	24	29				
30,000	60	39	25	33	38	18	9	-66	-43	-26	-37	-41	-63	-75	28	30	20	30				
20,000	41	30	17	22	26	12	5	-44	-31	-18	-24	-28	-44	-54	23	23	13	23				
ALBANY, GA. TO TAMPA																			231 N.MI.			
53,000	13	16	1	7	9	-2	-7	-19	-19	-2	-9	-11	-23	-30	16	17	11	18				
40,000	16	18	7	12	13	-3	-12	-27	-27	-8	-17	-19	-36	-46	26	26	19	24				
30,000	14	19	4	10	11	-3	-10	-21	-24	-5	-13	-15	-30	-39	22	23	15	22				
20,000	9	10	1	3	5	-4	-10	-13	-12	-2	-5	-7	-18	-24	18	18	10	16				
ALBANY, N.Y. TO BUFFALO																			217 N.MI.			
53,000	-45	-28	-14	-29	-28	-41	-49	44	28	13	29	27	15	9	18	16	13	16				
40,000	-72	-48	-41	-52	-53	-73	-85	70	46	39	50	50	31	20	30	29	25	29				
30,000	-70	-46	-37	-47	-48	-70	-82	67	43	35	44	46	26	15	33	32	22	30				
20,000	-47	-31	-25	-32	-32	-48	-57	45	30	24	30	31	17	9	24	24	15	23				
ALBUQUERQUE TO AMARILLO																			241 N.MI.			
53,000	41	34	5	22	25	10	4	-42	-34	-6	-23	-26	-41	-49	19	16	12	16				
40,000	65	51	24	42	44	24	14	-67	-53	-25	-43	-46	-68	-80	31	28	22	27				
30,000	53	44	18	32	34	16	7	-56	-46	-19	-34	-36	-57	-70	32	28	17	26				
20,000	34	28	11	17	21	8	2	-35	-29	-11	-18	-21	-36	-45	22	20	12	18				
ALBUQUERQUE TO CHICAGO																			969 N.MI.			
53,000	37	28	9	21	23	12	7	-38	-29	-9	-22	-24	-36	-43	15	13	10	13				
40,000	62	43	29	34	42	25	17	-66	-45	-31	-41	-44	-62	-72	24	22	19	23				
30,000	51	37	22	31	33	18	11	-55	-40	-23	-34	-36	-54	-64	26	23	15	23				
20,000	37	24	15	19	21	11	6	-34	-25	-16	-21	-23	-35	-42	19	17	10	17				
ALBUQUERQUE TO DALLAS																			503 N.MI.			
53,000	41	32	3	21	24	9	3	-43	-33	-4	-21	-25	-40	-47	17	15	11	15				
40,000	61	49	18	41	41	22	12	-65	-52	-19	-43	-44	-65	-77	29	26	20	24				
30,000	51	42	14	32	32	15	6	-54	-44	-14	-34	-34	-55	-67	29	25	15	24				
20,000	34	28	6	17	19	7	1	-35	-29	-7	-18	-20	-35	-44	20	18	10	17				
ALBUQUERQUE TO DENVER																			295 N.MI.			
53,000	7	10	6	4	7	-4	-9	-11	-12	-6	-5	-8	-19	-25	18	16	12	16				
40,000	11	11	14	7	11	-7	-17	-22	-17	-17	-13	-17	-35	-45	30	27	22	27				
30,000	10	10	10	3	8	-9	-19	-18	-15	-12	-7	-12	-30	-40	32	28	18	26				
20,000	5	6	8	2	6	-7	-14	-8	-8	-9	-4	-7	-19	-26	22	20	12	19				
ALBUQUERQUE TO LAS VEGAS																			423 N.MI.			
53,000	-36	-30	-5	-21	-23	-36	-43	35	29	5	21	22	7	3	18	15	11	15				
40,000	-57	-48	-28	-39	-42	-61	-71	55	46	27	37	40	22	13	29	26	21	26				
30,000	-49	-41	-21	-31	-33	-53	-64	46	39	20	30	32	15	6	32	27	18	23				
20,000	-38	-25	-12	-16	-19	-33	-40	29	24	11	15	18	7	1	21	19	12	17				

*HEADWINDS--COMPUTED FOR A 440-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
ALBUQUERQUE TO LOS ANGELES																		
53,000	-36	-31	-6	-21	-23	-36	-43	35	31	5	20	22	9	4	17	14	11	14
40,000	-56	-48	-29	-37	-42	-60	-70	54	46	28	36	40	23	14	27	25	20	24
30,000	-48	-41	-20	-30	-33	-51	-62	45	39	20	28	31	15	7	30	26	17	22
20,000	-30	-25	-12	-15	-19	-32	-39	28	24	12	14	18	7	1	20	18	11	16
ALBUQUERQUE TO LUBBOCK																		
53,000	38	30	3	20	22	8	1	-40	-31	-3	-21	-23	-38	-46	19	16	12	16
40,000	58	47	19	39	39	20	10	-62	-50	-21	-41	-42	-64	-76	31	28	21	26
30,000	48	40	15	31	31	13	5	-51	-42	-16	-33	-33	-54	-66	32	27	17	25
20,000	32	26	7	16	18	6	0	-33	-27	-8	-17	-19	-34	-43	22	19	11	18
ALBUQUERQUE TO PHOENIX																		
53,000	-36	-33	-5	-20	-23	-37	-44	34	32	5	19	22	8	2	19	15	12	16
40,000	-57	-50	-27	-37	-42	-62	-73	54	48	26	35	40	21	12	30	27	21	26
30,000	-49	-42	-20	-30	-33	-53	-64	46	40	19	28	31	14	5	33	27	18	23
20,000	-30	-25	-13	-14	-19	-32	-40	28	24	12	14	18	7	1	22	19	11	18
ALBUQUERQUE TO SAN FRANCISCO																		
53,000	-35	-27	-7	-21	-22	-34	-40	34	27	6	20	21	10	4	16	14	10	13
40,000	-53	-43	-28	-37	-40	-57	-66	51	41	26	35	38	21	13	26	23	20	23
30,000	-46	-39	-21	-30	-32	-50	-60	43	37	19	29	30	15	6	28	25	17	22
20,000	-29	-23	-12	-16	-19	-31	-38	28	22	11	15	18	7	1	20	18	11	16
ALBUQUERQUE TO WICHITA																		
53,000	39	32	7	22	24	11	5	-40	-33	-7	-22	-25	-39	-46	18	15	12	15
40,000	65	48	26	39	43	24	15	-68	-50	-27	-42	-45	-66	-78	29	26	21	26
30,000	52	41	19	30	33	16	8	-55	-43	-20	-32	-35	-56	-67	30	26	16	25
20,000	32	26	12	18	20	9	3	-34	-27	-12	-19	-21	-35	-43	21	19	11	18
ALLENTOWN TO CLEVELAND																		
53,000	-47	-31	-13	-29	-28	-43	-51	45	30	12	28	28	15	9	18	17	13	16
40,000	-76	-51	-39	-51	-53	-74	-86	74	48	37	48	51	31	21	29	28	24	28
30,000	-73	-47	-32	-46	-48	-70	-82	70	45	31	43	46	26	16	29	30	20	30
20,000	-50	-33	-22	-30	-32	-48	-58	48	31	22	29	31	17	10	23	23	14	22
ALLENTOWN TO PITTSBURGH																		
53,000	-49	-31	-12	-30	-29	-45	-53	48	31	11	29	29	15	8	19	17	13	16
40,000	-78	-52	-38	-53	-54	-76	-88	76	50	36	51	52	31	21	30	29	25	29
30,000	-74	-49	-32	-47	-49	-71	-84	72	46	31	45	47	26	17	30	31	20	30
20,000	-51	-33	-22	-31	-32	-49	-59	50	32	22	30	31	17	10	24	24	14	23
AMARILLO TO COLORADO SPRINGS																		
53,000	-25	-16	-2	-15	-14	-26	-33	22	14	2	14	12	1	-5	19	16	12	16
40,000	-39	-27	-15	-28	-26	-45	-56	29	21	12	23	21	3	-7	31	27	22	27
30,000	-31	-23	-13	-25	-21	-40	-51	24	18	11	22	18	1	-8	32	28	18	27
20,000	-23	-16	-6	-14	-13	-27	-35	20	14	5	13	12	0	-6	22	20	12	19
AMARILLO TO DALLAS																		
53,000	38	27	4	19	21	7	1	-40	-29	-4	-20	-22	-37	-45	18	16	12	16
40,000	51	41	15	38	35	16	6	-58	-46	-17	-41	-39	-60	-72	30	28	21	26
30,000	42	35	12	31	28	11	2	-48	-39	-13	-33	-31	-51	-63	30	26	16	26
20,000	31	25	4	17	17	5	-1	-33	-27	-5	-18	-19	-34	-43	21	19	11	18
AMARILLO TO DENVER																		
53,000	-22	-14	-2	-14	-12	-24	-31	19	11	1	13	10	-1	-6	18	16	12	15
40,000	-35	-23	-14	-25	-23	-43	-53	25	17	10	20	18	0	-9	30	27	22	27
30,000	-28	-20	-11	-23	-19	-37	-48	20	15	9	19	15	-2	-11	32	28	17	27
20,000	-21	-14	-5	-14	-12	-25	-33	18	12	4	12	10	-1	-8	22	20	12	19
AMARILLO TO OKLAHOMA CITY																		
53,000	45	35	5	24	27	11	4	-46	-36	-6	-24	-27	-44	-51	19	17	13	16
40,000	70	53	21	45	45	24	14	-73	-55	-22	-47	-48	-71	-84	31	28	22	27
30,000	57	45	15	34	35	16	7	-60	-47	-16	-36	-37	-60	-73	31	27	17	26
20,000	37	30	9	19	22	8	2	-39	-31	-9	-20	-23	-39	-48	22	20	12	19
AMARILLO TO WICHITA																		
53,000	35	30	6	19	22	8	2	-38	-31	-6	-20	-23	-37	-45	19	17	12	16
40,000	62	44	20	35	39	17	7	-66	-47	-22	-38	-42	-64	-76	31	28	22	27
30,000	50	38	14	25	29	11	2	-53	-41	-15	-28	-32	-53	-66	31	27	17	26
20,000	29	24	9	15	17	5	-1	-32	-25	-10	-16	-19	-33	-42	22	20	12	19

*HEADWINDS--COMPUTED FOR A 450-MPH AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

THE BOEING COMPANY
TRANSPORT DIVISION

NO. 36-V176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEAD WINDS*								STANDARD DEVIATION					
	D I R E C T								R E T U R N													
	JAN	APR	JUL	OCT	••A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
ANCHORAGE TO CHICAGO																			2465 N.M.I.			
53,000	28	12	9	20	16	10	7	-29	-13	-9	-21	-17	-25	-30	10	8	6	8				
40,000	32	17	20	25	23	14	9	-34	-19	-22	-28	-25	-35	-40	13	12	12	14				
30,000	32	19	18	25	23	13	7	-34	-21	-20	-27	-25	-36	-42	15	15	13	16				
20,000	23	14	13	19	17	9	6	-24	-15	-14	-20	-18	-25	-30	12	10	8	11				
ANCHORAGE TO EDMONTON, CANADA																			1253 N.M.I.			
53,000	26	11	6	19	14	6	2	-27	-11	-6	-19	-15	-24	-30	13	11	8	10				
40,000	29	13	12	21	19	7	1	-31	-15	-13	-23	-20	-32	-39	17	15	16	17				
30,000	28	14	11	20	18	5	-3	-30	-16	-13	-23	-20	-34	-42	20	20	18	21				
20,000	18	9	8	14	12	2	-2	-20	-10	-8	-15	-13	-23	-28	16	14	12	14				
ANCHORAGE TO FAIRBANKS																			226 N.M.I.			
53,000	7	5	1	9	5	-4	-9	-9	-5	-1	-9	-6	-15	-21	18	14	9	13				
40,000	5	9	7	13	9	-5	-13	-7	-10	-8	-15	-10	-24	-32	22	19	20	21				
30,000	3	11	6	14	8	-9	-18	-6	-12	-8	-16	-10	-28	-37	27	25	25	27				
20,000	2	9	5	9	7	-6	-13	-4	-9	-6	-10	-8	-20	-27	22	18	16	18				
ANCHORAGE TO JUNEAU																			494 N.M.I.			
53,000	23	8	4	16	11	2	-2	-24	-8	-4	-17	-12	-22	-29	17	13	9	13				
40,000	28	13	13	16	17	3	-4	-29	-14	-15	-19	-19	-33	-41	22	19	20	22				
30,000	24	10	10	14	14	-3	-13	-26	-13	-12	-17	-16	-34	-44	26	25	24	27				
20,000	14	4	6	8	8	-4	-11	-16	-5	-7	-9	-9	-21	-28	21	18	16	17				
ANCHORAGE TO KING SALMON																			250 N.M.I.			
53,000	-22	-9	-4	-17	-12	-23	-30	20	9	4	17	11	1	-4	19	15	9	14				
40,000	-24	-16	-16	-23	-20	-35	-43	22	15	15	22	18	3	-4	24	20	22	23				
30,000	-21	-16	-16	-21	-19	-37	-46	19	15	14	19	17	-1	-11	28	26	26	27				
20,000	-13	-10	-10	-14	-12	-25	-33	11	9	9	13	11	-3	-11	25	20	18	20				
ANCHORAGE TO LOS ANGELES																			2036 N.M.I.			
53,000	19	9	3	10	9	2	-1	-20	-10	-3	-11	-10	-18	-23	11	9	7	9				
40,000	26	17	12	15	17	6	0	-30	-20	-14	-18	-20	-32	-38	17	15	15	17				
30,000	23	14	9	11	14	2	-5	-28	-18	-12	-15	-18	-31	-38	19	18	16	19				
20,000	15	6	7	6	8	-1	-5	-17	-8	-8	-8	-10	-19	-24	16	14	10	13				
ANCHORAGE TO MINNEAPOLIS																			2181 N.M.I.			
53,000	28	12	8	20	16	9	6	-28	-13	-9	-21	-17	-25	-29	10	8	6	8				
40,000	31	16	18	24	22	12	7	-33	-18	-20	-26	-24	-34	-40	14	12	13	15				
30,000	31	17	17	24	22	11	5	-33	-19	-18	-26	-24	-35	-42	16	16	14	17				
20,000	22	13	12	18	16	8	4	-23	-14	-13	-19	-17	-25	-29	12	11	9	11				
ANCHORAGE TO NEW YORK																			2932 N.M.I.			
53,000	27	13	10	19	16	10	7	-29	-13	-10	-20	-17	-25	-29	9	7	6	7				
40,000	31	19	21	26	24	16	11	-34	-21	-23	-29	-26	-35	-40	12	11	11	13				
30,000	31	21	20	25	24	15	10	-34	-23	-22	-28	-26	-36	-41	14	13	12	14				
20,000	22	15	15	18	17	11	7	-23	-16	-16	-19	-18	-25	-29	11	10	8	10				
ANCHORAGE TO SEATTLE																			1255 N.M.I.			
53,000	21	9	5	14	11	3	0	-22	-9	-5	-15	-12	-21	-26	13	11	8	10				
40,000	24	15	15	18	19	6	0	-31	-17	-17	-21	-21	-34	-41	19	17	17	19				
30,000	26	12	13	13	16	1	-7	-29	-15	-15	-17	-19	-34	-42	22	22	20	23				
20,000	15	5	8	9	9	-1	-7	-17	-6	-9	-11	-11	-21	-27	18	16	13	16				
ANNETTE ISL., ALASKA TO JUNEAU																			222 N.M.I.			
53,000	-16	-5	-3	-9	-7	-18	-23	14	4	3	8	7	-3	-8	17	15	11	13				
40,000	-22	-5	-9	-7	-11	-27	-36	19	3	8	4	8	-8	-16	23	22	23	24				
30,000	-20	-3	-8	-4	-9	-28	-38	16	0	6	0	5	-14	-24	28	28	26	29				
20,000	-10	1	-5	-2	-4	-17	-25	8	-2	4	0	2	-11	-18	23	20	17	19				
ANNETTE ISL., ALASKA TO SEATTLE																			571 N.M.I.			
53,000	22	9	5	13	11	2	-2	-23	-10	-6	-14	-12	-22	-28	16	13	11	12				
40,000	28	16	15	21	19	4	-4	-31	-18	-17	-24	-22	-38	-47	23	22	22	25				
30,000	26	13	14	15	17	-1	-11	-30	-17	-16	-19	-20	-39	-48	27	27	24	27				
20,000	16	6	10	11	10	-3	-10	-18	-8	-11	-13	-12	-25	-33	22	20	16	20				
ATLANTA TO BALTIMORE																			500 N.M.I.			
53,000	39	25	0	20	21	6	-1	-42	-27	-1	-21	-22	-38	-46	16	17	11	15				
40,000	36	39	12	41	36	16	6	-63	-45	-14	-44	-41	-63	-75	26	27	21	26				
30,000	31	34	12	34	31	13	5	-57	-39	-13	-37	-35	-57	-68	24	27	17	27				
20,000	37	23	10	21	21	8	2	-40	-25	-11	-23	-23	-38	-47	20	20	11	19				

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

••A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
ATLANTA TO CHARLESTON, S.C.																		
53,000	51	37	1	23	27	8	1	-52	-37	-2	-24	-29	-47	-55	17	18	11	17
40,000	71	56	14	44	46	22	11	-74	-59	-15	-47	-48	-72	-85	27	29	21	27
30,000	62	47	10	36	38	16	7	-64	-49	-11	-38	-39	-63	-74	24	27	16	26
20,000	39	31	8	20	22	9	3	-41	-32	-8	-21	-23	-40	-49	20	20	11	19
ATLANTA TO CHARLESTON, W.VA.																		
53,000	21	14	-3	11	10	-2	-8	-27	-17	2	-13	-13	-27	-34	17	17	11	16
40,000	31	21	2	24	19	0	-10	-44	-29	-4	-30	-26	-47	-58	27	29	22	27
30,000	28	18	4	20	16	-1	-9	-38	-24	-5	-25	-22	-41	-53	25	28	17	28
20,000	23	12	5	12	12	0	-6	-28	-15	-5	-14	-14	-28	-37	21	21	12	20
ATLANTA TO CHICAGO																		
53,000	-17	-12	-7	-9	-11	-21	-27	11	9	7	7	8	-1	-7	17	16	11	15
40,000	-28	-20	-16	-16	-20	-37	-46	13	13	14	9	12	-5	-14	27	26	21	26
30,000	-24	-18	-11	-14	-16	-33	-42	13	12	9	8	10	-6	-15	26	27	17	27
20,000	-14	-12	-6	-10	-10	-22	-29	8	9	5	7	7	-4	-11	21	20	12	20
ATLANTA TO CINCINNATI																		
53,000	-4	-3	-5	-1	-4	-14	-19	-3	-1	5	-1	1	-10	-16	18	17	11	16
40,000	-6	-6	-9	-1	-6	-23	-33	-10	-3	6	-7	-3	-21	-31	28	28	22	27
30,000	-5	-5	-5	0	-4	-20	-29	-8	-2	3	-5	-2	-19	-29	26	28	17	28
20,000	1	-4	-2	0	-1	-13	-20	-7	0	1	-2	-2	-14	-21	21	21	12	20
ATLANTA TO CLEVELAND																		
53,000	13	7	-3	8	5	-5	-10	-19	-10	2	-10	-8	-20	-27	17	16	11	15
40,000	15	10	-1	15	9	-8	-17	-30	-18	-2	-22	-17	-36	-46	27	27	21	26
30,000	14	9	2	13	9	-7	-16	-26	-16	-4	-19	-15	-33	-43	25	27	17	27
20,000	13	5	3	8	7	-5	-12	-19	-8	-4	-11	-9	-23	-30	21	21	12	20
ATLANTA TO DALLAS																		
53,000	-51	-38	-1	-24	-29	-46	-54	50	37	1	23	28	9	1	16	15	10	15
40,000	-77	-59	-13	-48	-50	-73	-85	75	57	12	47	48	24	12	26	26	19	23
30,000	-66	-49	-9	-37	-39	-63	-74	64	47	8	36	37	15	6	24	24	15	25
20,000	-42	-32	-5	-21	-23	-40	-48	41	31	5	20	23	8	3	19	18	10	17
ATLANTA TO DETROIT																		
53,000	4	2	-4	3	1	-9	-14	-10	-5	4	-5	-4	-15	-20	17	16	11	15
40,000	3	1	-6	6	1	-16	-25	-18	-9	2	-13	-9	-27	-37	27	27	21	26
30,000	3	1	-2	5	1	-14	-23	-16	-8	0	-11	-8	-25	-34	26	27	17	27
20,000	5	-1	0	3	2	-10	-16	-11	-3	-1	-6	-5	-17	-24	21	20	12	20
ATLANTA TO GREENSBORO																		
53,000	43	30	-1	20	22	6	-1	-46	-31	0	-22	-24	-42	-50	17	18	11	17
40,000	63	46	10	43	40	17	6	-69	-50	-12	-46	-44	-68	-80	27	29	21	27
30,000	57	39	9	35	33	13	4	-61	-43	-10	-38	-37	-60	-71	24	28	17	28
20,000	40	27	8	21	22	8	2	-42	-29	-9	-22	-23	-40	-49	21	21	11	20
ATLANTA TO HOUSTON																		
53,000	-49	-35	5	-20	-26	-43	-51	47	34	-5	19	25	4	-4	16	15	10	15
40,000	-73	-57	-5	-44	-46	-69	-81	71	54	4	42	43	19	6	25	25	19	22
30,000	-62	-46	-5	-33	-36	-58	-69	60	43	4	31	33	12	3	23	23	14	23
20,000	-39	-29	0	-18	-20	-37	-45	38	28	0	17	19	4	-2	18	17	9	16
ATLANTA TO INDIANAPOLIS																		
53,000	-14	-10	-6	-7	-9	-19	-25	8	7	6	5	6	-4	-9	17	17	11	16
40,000	-21	-17	-13	-12	-16	-33	-43	6	9	11	4	8	-10	-19	27	28	22	27
30,000	-19	-15	-8	-9	-12	-29	-39	6	8	7	4	6	-10	-19	26	28	17	28
20,000	-9	-10	-4	-6	-7	-19	-26	3	7	4	4	4	-8	-15	21	21	12	20
ATLANTA TO JACKSONVILLE																		
53,000	27	23	3	13	15	3	-3	-31	-26	-3	-14	-17	-32	-39	17	17	11	17
40,000	35	32	11	23	24	6	-3	-44	-39	-12	-27	-30	-49	-60	26	28	20	26
30,000	30	29	7	18	20	4	-4	-37	-33	-7	-22	-24	-42	-52	23	25	16	25
20,000	18	17	4	9	11	0	-5	-22	-20	-5	-10	-13	-26	-33	19	19	10	18
ATLANTA TO LOS ANGELES																		
53,000	-44	-35	-5	-23	-27	-40	-46	43	34	4	22	27	12	5	13	11	8	11
40,000	-67	-54	-23	-44	-46	-64	-73	65	51	22	42	44	28	20	20	19	15	18
30,000	-57	-46	-16	-34	-37	-54	-63	54	44	15	33	35	19	13	21	19	12	18
20,000	-36	-29	-10	-19	-22	-35	-41	35	28	10	18	21	11	7	15	13	8	13

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	DIRECT								RETURN											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
ATLANTA TO LOUISVILLE																			279 N.MI.	
53,000	-14	-10	-6	-6	-9	-20	-26	8	7	6	4	6	-4	-10	18	17	11	16		
40,000	-20	-17	-13	-11	-15	-33	-43	5	8	11	4	7	-11	-21	28	29	22	27		
30,000	-17	-15	-8	-9	-12	-29	-38	5	8	6	3	5	-11	-20	26	28	17	29		
20,000	-7	-10	-4	-5	-6	-18	-26	1	6	3	3	3	-9	-15	21	21	12	20		
ATLANTA TO MELBOURNE																			386 N.MI.	
53,000	22	21	2	10	13	1	-4	-27	-24	-2	-12	-15	-28	-35	16	17	10	17		
40,000	27	26	9	18	19	3	-5	-37	-34	-10	-23	-25	-43	-53	25	26	19	24		
30,000	24	25	5	15	16	2	-5	-31	-30	-6	-18	-20	-36	-46	21	23	15	23		
20,000	15	14	2	6	8	-2	-7	-18	-16	-3	-8	-10	-22	-29	18	18	10	16		
ATLANTA TO MEMPHIS																			288 N.MI.	
53,000	-50	-37	-4	-24	-28	-46	-54	49	36	4	24	27	10	3	18	17	11	16		
40,000	-73	-57	-18	-48	-48	-72	-84	69	54	17	45	46	23	13	28	29	21	26		
30,000	-64	-47	-12	-38	-39	-63	-75	60	45	11	35	36	15	6	26	27	17	28		
20,000	-40	-32	-9	-22	-24	-41	-49	38	31	9	21	23	9	3	21	20	11	19		
ATLANTA TO MIAMI																			518 N.MI.	
53,000	16	17	2	8	10	0	-5	-21	-20	-2	-9	-12	-24	-31	15	16	10	16		
40,000	20	20	8	13	15	0	-8	-30	-29	-9	-18	-20	-37	-46	24	24	18	23		
30,000	17	21	5	11	12	0	-7	-24	-26	-5	-14	-16	-31	-39	20	21	14	21		
20,000	11	11	1	4	6	-3	-8	-14	-13	-1	-5	-7	-18	-25	17	16	9	14		
ATLANTA TO MOBILE																			263 N.MI.	
53,000	-41	-28	5	-17	-20	-37	-46	38	26	-5	16	18	2	-6	17	17	11	17		
40,000	-63	-47	-2	-37	-37	-61	-73	57	41	1	33	33	10	-1	27	28	20	25		
30,000	-53	-36	-4	-29	-29	-51	-62	49	32	3	26	26	6	-2	24	26	16	25		
20,000	-34	-24	-1	-16	-17	-33	-41	32	22	1	15	16	2	-3	19	19	10	18		
ATLANTA TO NEW ORLEANS																			369 N.MI.	
53,000	-45	-31	6	-18	-23	-40	-48	42	29	-6	17	21	2	-5	17	17	11	16		
40,000	-67	-51	-3	-39	-41	-64	-76	63	46	2	36	37	13	1	26	27	20	23		
30,000	-57	-40	-4	-30	-32	-54	-65	53	36	3	28	29	8	0	24	25	16	25		
20,000	-36	-26	-1	-17	-18	-35	-43	34	24	0	16	17	3	-3	19	18	10	17		
ATLANTA TO NEW YORK																			659 N.MI.	
53,000	40	25	2	22	21	7	1	-43	-27	-2	-23	-23	-38	-46	16	16	11	15		
40,000	57	40	15	42	38	18	9	-64	-45	-18	-46	-43	-63	-75	25	26	20	25		
30,000	52	36	15	36	33	15	7	-59	-40	-16	-39	-37	-58	-69	24	26	16	26		
20,000	39	24	12	23	22	10	4	-42	-26	-12	-24	-24	-40	-48	20	20	11	19		
ATLANTA TO NORFOLK																			448 N.MI.	
53,000	47	32	1	23	25	8	1	-49	-33	-1	-24	-26	-44	-52	16	17	11	16		
40,000	68	50	14	47	44	21	10	-72	-53	-15	-49	-47	-70	-83	26	28	21	26		
30,000	61	43	12	38	37	17	7	-64	-46	-13	-41	-40	-63	-74	24	27	16	26		
20,000	43	29	10	23	24	11	5	-44	-31	-11	-24	-25	-42	-51	20	20	11	19		
ATLANTA TO ORLANDO																			345 N.MI.	
53,000	19	19	2	9	11	1	-5	-24	-22	-3	-11	-14	-27	-34	16	17	11	17		
40,000	24	24	9	16	17	1	-7	-34	-32	-10	-21	-23	-41	-51	25	27	19	25		
30,000	21	23	5	13	15	0	-7	-28	-28	-6	-17	-19	-35	-44	22	24	15	23		
20,000	13	13	3	6	8	-2	-8	-17	-15	-3	-7	-9	-21	-28	18	18	10	16		
ATLANTA TO PHILADELPHIA																			579 N.MI.	
53,000	40	25	1	21	21	7	0	-43	-27	-1	-22	-23	-39	-46	16	16	11	15		
40,000	57	40	14	42	37	17	8	-64	-45	-16	-45	-42	-63	-75	26	27	21	26		
30,000	52	35	13	35	32	14	6	-58	-40	-15	-38	-36	-57	-68	24	26	16	26		
20,000	38	23	11	22	22	9	3	-41	-26	-12	-23	-23	-39	-48	20	20	11	19		
ATLANTA TO PITTSBURGH																			457 N.MI.	
53,000	23	14	-2	13	11	-1	-6	-28	-17	1	-14	-14	-27	-34	17	17	11	15		
40,000	30	21	4	25	19	1	-9	-43	-28	-7	-31	-27	-47	-57	27	27	21	27		
30,000	28	18	6	22	17	1	-8	-39	-24	-8	-26	-23	-42	-53	25	27	17	27		
20,000	23	11	6	14	12	0	-6	-28	-14	-7	-16	-14	-29	-37	21	21	12	20		
ATLANTA TO RALEIGH																			509 N.MI.	
53,000	47	33	0	22	25	7	0	-49	-34	0	-23	-26	-44	-52	17	18	11	16		
40,000	69	50	12	47	44	20	9	-73	-54	-13	-49	-47	-72	-84	27	29	21	27		
30,000	61	43	10	38	37	15	6	-65	-46	-11	-40	-39	-63	-74	24	27	17	27		
20,000	43	29	9	22	23	10	4	-44	-31	-9	-23	-25	-42	-51	20	20	11	19		

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	DCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
ATLANTA TO ST. LOUIS																		
53,000	-36	-26	-7	-18	-21	-35	-42	32	24	7	17	19	7	2	17	17	11	15
40,000	-53	-41	-21	-35	-36	-56	-67	43	35	19	30	31	13	4	27	27	21	26
30,000	-47	-35	-14	-28	-29	-49	-60	38	30	13	24	25	8	0	27	27	17	28
20,000	-29	-23	-10	-18	-18	-32	-41	24	21	9	16	16	5	-1	21	20	11	20
ATLANTA TO ST. PETERSBURG																		
53,000	7	11	3	5	6	-4	-9	-13	-14	-3	-6	-9	-20	-25	16	17	10	17
40,000	7	10	8	7	8	-8	-16	-19	-20	-9	-12	-14	-31	-40	25	26	19	24
30,000	7	13	4	6	7	-7	-14	-15	-19	-5	-9	-11	-26	-34	22	23	15	23
20,000	4	6	2	2	3	-7	-12	-8	-9	-2	-3	-5	-15	-22	18	18	10	16
ATLANTA TO SAN ANTONIO																		
53,000	-49	-37	5	-20	-27	-44	-51	48	36	-5	19	26	5	-4	15	15	10	14
40,000	-74	-59	-6	-45	-47	-70	-81	72	56	5	43	45	20	7	24	24	18	21
30,000	-63	-47	-4	-34	-37	-59	-70	61	45	4	32	35	13	3	23	22	14	22
20,000	-39	-30	0	-18	-21	-37	-45	38	29	0	17	20	5	-1	17	16	9	15
ATLANTA TO SAN FRANCISCO																		
53,000	-41	-31	-8	-23	-26	-37	-43	40	31	7	23	25	13	8	12	11	8	10
40,000	-63	-48	-28	-43	-45	-60	-69	60	46	26	41	42	28	22	19	18	15	18
30,000	-54	-42	-20	-35	-36	-52	-61	51	40	19	33	34	20	14	20	18	12	18
20,000	-35	-27	-12	-20	-22	-33	-40	33	26	12	19	21	12	8	15	13	8	13
ATLANTA TO SHREVEPORT																		
53,000	-51	-38	0	-23	-29	-46	-54	50	37	-1	23	28	8	0	17	16	11	15
40,000	-77	-59	-11	-48	-49	-73	-85	75	57	10	46	48	23	10	26	27	20	23
30,000	-66	-49	-8	-37	-39	-63	-74	64	47	8	36	37	15	5	25	25	15	25
20,000	-42	-32	-4	-21	-23	-40	-49	41	31	4	20	22	7	2	19	18	10	18
ATLANTA TO TAMPA																		
53,000	9	12	3	5	7	-3	-8	-15	-15	-3	-7	-9	-20	-27	16	17	10	17
40,000	9	12	8	8	9	-7	-15	-21	-21	-9	-13	-16	-32	-41	25	26	19	24
30,000	8	14	4	7	8	-6	-13	-17	-20	-5	-10	-12	-27	-35	22	23	15	23
20,000	5	7	2	2	4	-6	-12	-9	-10	-2	-3	-5	-16	-22	18	18	10	16
ATLANTA TO WASHINGTON, D.C.																		
53,000	39	26	0	20	21	6	-1	-42	-28	-1	-21	-22	-38	-46	17	17	11	16
40,000	56	40	12	41	37	16	6	-64	-45	-14	-44	-41	-63	-75	26	27	21	26
30,000	51	35	11	34	31	13	4	-57	-39	-13	-37	-35	-57	-68	24	27	17	27
20,000	38	23	10	21	21	8	2	-40	-25	-10	-22	-23	-38	-47	20	20	11	19
BALTIMORE TO BOSTON																		
53,000	40	22	7	26	23	9	3	-42	-24	-8	-27	-24	-39	-47	19	17	12	16
40,000	57	39	27	46	41	21	11	-64	-43	-30	-49	-46	-67	-78	30	29	25	29
30,000	55	36	25	39	37	18	8	-61	-40	-27	-43	-41	-63	-75	32	31	21	30
20,000	41	24	18	27	26	12	5	-44	-27	-19	-29	-28	-44	-53	23	23	13	22
BALTIMORE TO BUFFALO																		
53,000	-16	-14	-8	-8	-11	-22	-29	10	11	8	6	9	-2	-8	19	17	13	16
40,000	-35	-23	-21	-17	-24	-43	-53	22	16	17	9	16	-3	-13	30	29	25	29
30,000	-33	-22	-15	-15	-21	-40	-51	21	16	12	8	14	-5	-15	30	31	21	30
20,000	-20	-18	-10	-9	-14	-28	-36	14	15	9	6	10	-3	-11	24	23	14	23
BALTIMORE TO CHARLOTTE																		
53,000	-38	-23	0	-20	-20	-35	-43	34	21	0	19	17	4	-3	17	18	12	16
40,000	-56	-39	-13	-42	-37	-58	-70	46	33	11	37	31	11	1	28	29	22	28
30,000	-51	-35	-13	-36	-32	-53	-64	42	30	12	32	27	10	1	26	29	18	28
20,000	-37	-22	-11	-22	-21	-36	-46	33	19	10	20	19	6	0	22	22	12	21
BALTIMORE TO CHICAGO																		
53,000	-44	-30	-13	-27	-27	-41	-48	43	29	12	26	26	14	9	17	16	12	15
40,000	-73	-49	-38	-47	-51	-71	-82	70	46	36	44	48	30	20	27	26	22	27
30,000	-69	-45	-30	-43	-45	-66	-78	66	43	29	39	43	24	15	27	28	18	28
20,000	-47	-31	-21	-28	-30	-46	-55	45	30	20	27	29	16	9	22	21	13	21
BALTIMORE TO DALLAS																		
53,000	-48	-34	-4	-25	-28	-43	-50	47	33	3	24	27	11	4	15	14	9	13
40,000	-76	-54	-20	-48	-49	-70	-81	73	51	18	46	46	26	16	23	23	18	22
30,000	-67	-46	-15	-40	-41	-62	-73	65	44	14	37	38	19	11	22	23	14	23
20,000	-45	-31	-12	-24	-26	-41	-49	43	29	11	23	25	12	7	18	17	10	16

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
BALTIMORE TO DENVER																		
53,000	-44	-31	-12	-27	-28	-40	-46	43	30	12	26	27	16	11	1302 N.MI.			
40,000	-74	-48	-38	-47	-50	-68	-77	72	47	36	45	48	33	25	14	13	9	12
30,000	-65	-44	-29	-42	-43	-60	-71	62	42	28	39	41	26	19	22	20	18	22
20,000	-43	-29	-20	-28	-28	-41	-48	42	28	19	27	27	17	12	23	22	14	22
															17	17	10	16
BALTIMORE TO DETROIT																		
53,000	-39	-27	-12	-24	-24	-37	-45	36	26	12	22	23	11	6	355 N.MI.			
40,000	-68	-45	-36	-42	-47	-67	-79	63	41	34	38	43	24	14	18	17	12	15
30,000	-65	-42	-28	-38	-42	-63	-75	59	39	27	34	38	19	10	29	28	24	28
20,000	-44	-30	-19	-25	-28	-44	-53	41	29	19	23	26	13	6	28	29	20	29
															23	23	13	22
BALTIMORE TO HOUSTON																		
53,000	-46	-32	1	-22	-25	-40	-48	44	30	-1	21	24	7	0	1080 N.MI.			
40,000	-71	-51	-12	-45	-45	-66	-76	67	47	10	42	41	21	10	14	14	9	13
30,000	-62	-43	-10	-36	-37	-58	-68	59	40	9	33	34	15	7	22	23	17	21
20,000	-41	-28	-6	-21	-22	-38	-45	39	26	6	20	21	8	3	21	22	13	22
															17	16	9	16
BALTIMORE TO KANSAS CITY																		
53,000	-48	-33	-11	-28	-29	-43	-50	47	32	10	27	28	15	9	833 N.MI.			
40,000	-77	-52	-34	-50	-52	-72	-83	75	50	33	48	50	32	23	16	15	10	13
30,000	-71	-47	-27	-44	-45	-66	-78	68	45	26	42	43	25	17	25	24	20	25
20,000	-48	-32	-19	-29	-30	-45	-54	46	30	19	28	29	17	11	25	25	16	25
															19	19	11	19
BALTIMORE TO LOS ANGELES																		
53,000	-42	-31	-9	-24	-27	-37	-43	40	31	9	24	26	15	9	2018 N.MI.			
40,000	-68	-48	-33	-44	-47	-62	-71	65	46	32	42	45	32	25	12	10	8	10
30,000	-59	-43	-25	-37	-39	-54	-63	56	41	24	35	37	24	18	19	17	14	17
20,000	-38	-28	-17	-23	-25	-36	-42	37	27	16	22	24	15	11	20	18	12	17
															14	13	8	13
BALTIMORE TO MIAMI																		
53,000	-14	-6	3	-6	-5	-15	-22	9	2	-4	4	2	-7	-12	822 N.MI.			
40,000	-21	-17	2	-16	-12	-29	-37	9	8	-4	11	6	-9	-17	14	15	9	15
30,000	-17	-10	0	-13	-9	-23	-31	8	3	-1	9	5	-8	-15	22	24	17	23
20,000	-12	-7	-4	-9	-8	-17	-23	8	4	3	8	6	-3	-8	20	21	14	21
															17	16	9	15
BALTIMORE TO MONTREAL																		
53,000	16	7	0	12	8	-2	-8	-21	-9	-1	-14	-11	-23	-29	399 N.MI.			
40,000	20	12	7	20	14	-4	-14	-32	-19	-12	-27	-22	-41	-52	18	16	12	15
30,000	19	10	8	18	13	-5	-15	-31	-16	-12	-24	-20	-39	-51	29	27	24	28
20,000	16	6	6	13	9	-4	-11	-22	-9	-8	-16	-13	-27	-35	31	30	21	29
															23	23	14	22
BALTIMORE TO PHOENIX																		
53,000	-44	-33	-8	-25	-28	-40	-46	43	33	7	24	27	14	8	1732 N.MI.			
40,000	-72	-52	-29	-46	-48	-65	-75	69	50	28	44	46	31	23	12	11	8	11
30,000	-62	-46	-22	-38	-40	-58	-67	60	43	21	36	38	23	17	20	19	15	19
20,000	-41	-29	-15	-23	-25	-38	-44	39	28	15	22	24	14	10	21	19	12	19
															15	14	8	13
BALTIMORE TO PROVIDENCE																		
53,000	42	24	7	27	24	10	4	-44	-25	-8	-28	-25	-40	-48	284 N.MI.			
40,000	60	41	28	47	43	23	13	-66	-45	-31	-50	-47	-69	-80	19	17	12	16
30,000	58	39	26	41	39	20	10	-64	-43	-28	-44	-43	-65	-77	30	29	25	29
20,000	43	26	18	28	27	13	6	-45	-28	-19	-29	-29	-45	-54	32	31	21	30
															24	23	13	22
BALTIMORE TO ROCHESTER, N.Y.																		
53,000	-7	-8	-6	-3	-6	-17	-23	1	6	6	0	3	-8	-14	241 N.MI.			
40,000	-20	-13	-14	-6	-13	-33	-43	6	6	10	-2	5	-14	-24	19	17	13	16
30,000	-19	-14	-9	-5	-11	-31	-41	6	7	5	-2	4	-14	-25	30	29	25	29
20,000	-10	-12	-6	-3	-7	-21	-29	3	8	4	0	4	-10	-18	31	31	21	30
															24	23	14	23
BALTIMORE TO ST. LOUIS																		
53,000	-50	-33	-10	-28	-29	-44	-52	49	33	9	28	29	15	8	639 N.MI.			
40,000	-78	-53	-33	-51	-53	-74	-85	76	51	31	49	51	31	22	17	16	11	14
30,000	-72	-48	-26	-45	-46	-68	-80	70	46	25	43	44	25	17	26	25	21	26
20,000	-49	-32	-19	-29	-30	-46	-56	48	31	19	28	29	16	10	26	27	17	27
															21	20	12	20
BALTIMORE TO SAN FRANCISCO																		
53,000	-39	-28	-13	-25	-25	-35	-40	38	28	12	24	25	16	11	2129 N.MI.			
40,000	-63	-43	-38	-44	-46	-60	-67	61	42	37	41	44	32	26	11	10	7	9
30,000	-56	-40	-29	-37	-39	-53	-61	53	38	28	35	37	25	19	18	17	14	18
20,000	-37	-26	-19	-24	-25	-35	-41	35	25	18	23	24	16	12	19	18	12	18
															14	13	8	13

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*								STANDARD DEVIATION													
	D I R E C T							R E T U R N														
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
BALTIMORE TO SYRACUSE																			238 N.MI.			
53,000	7	0	-3	6	2	-9	-14	-13	-3	2	-9	-5	-17	-23	19	17	13	16				
40,000	2	1	-3	9	2	-17	-27	-16	-9	-2	-17	-11	-30	-41	30	29	25	29				
30,000	2	0	1	8	3	-16	-26	-15	-7	-4	-15	-10	-29	-40	31	31	21	30				
20,000	5	-2	1	6	2	-11	-19	-11	-2	-3	-9	-6	-20	-28	24	23	14	23				
BALTIMORE TO TAMPA																			733 N.MI.			
53,000	-24	-14	3	-11	-11	-23	-30	19	10	-4	9	8	-3	-8	15	15	10	15				
40,000	-35	-27	-1	-26	-22	-40	-50	24	19	-1	20	15	-2	-10	23	25	18	24				
30,000	-30	-20	-3	-21	-18	-34	-43	21	13	2	17	13	-1	-8	21	23	15	22				
20,000	-22	-13	-5	-13	-12	-24	-31	18	11	5	11	10	0	-5	18	17	10	16				
BERMUDA TO WASHINGTON																			717 N.MI.			
53,000	-43	-33	-7	-22	-25	-41	-48	41	31	7	21	24	10	4	17	17	10	15				
40,000	-60	-48	-20	-35	-39	-59	-71	55	44	18	31	36	18	9	26	26	19	24				
30,000	-54	-43	-16	-29	-33	-54	-64	50	40	15	26	30	14	6	26	25	15	23				
20,000	-37	-29	-11	-17	-21	-36	-44	34	27	11	15	20	9	3	19	18	10	17				
BILLINGS TO BISMARCK																			328 N.MI.			
53,000	29	19	16	22	21	11	7	-30	-19	-16	-23	-21	-31	-37	16	14	11	13				
40,000	41	29	42	36	37	20	11	-44	-30	-43	-38	-39	-56	-65	25	23	23	28				
30,000	41	27	35	34	34	16	6	-43	-29	-37	-36	-36	-54	-64	29	27	21	29				
20,000	28	19	23	24	23	11	5	-29	-20	-23	-26	-24	-37	-43	20	19	14	19				
BINGHAMPTON TO PITTSBURGH																			217 N.MI.			
53,000	-45	-27	-9	-28	-26	-41	-49	43	25	9	27	25	12	5	19	17	13	16				
40,000	-69	-45	-32	-50	-48	-70	-81	64	42	30	47	45	24	14	30	29	25	29				
30,000	-66	-42	-29	-45	-44	-66	-78	61	38	27	42	40	21	11	30	31	21	30				
20,000	-45	-27	-20	-30	-29	-45	-55	43	24	19	28	27	13	6	24	24	14	23				
BIRMINGHAM TO CHARLOTTE																			304 N.MI.			
53,000	49	35	0	23	27	8	0	-51	-36	-1	-24	-28	-46	-54	17	17	11	16				
40,000	74	53	12	47	47	22	10	-76	-56	-14	-49	-49	-73	-86	27	29	21	27				
30,000	65	45	10	38	38	16	6	-67	-47	-10	-40	-40	-64	-76	25	27	17	27				
20,000	43	31	8	22	24	10	3	-44	-32	-9	-23	-25	-42	-51	21	20	11	19				
BIRMINGHAM TO CHICAGO																			508 N.MI.			
53,000	-8	-5	-5	-4	-6	-15	-21	1	2	5	1	3	-7	-13	17	16	11	15				
40,000	-11	-10	-11	-7	-10	-27	-36	-4	2	8	0	2	-16	-25	27	26	21	26				
30,000	-10	-9	-7	-6	-8	-24	-33	-3	2	5	0	1	-15	-24	27	27	17	28				
20,000	-4	-6	-3	-5	-4	-16	-23	-2	3	2	2	1	-10	-17	21	20	12	20				
BIRMINGHAM TO GREENSBORO																			368 N.MI.			
53,000	48	33	0	23	25	8	0	-49	-34	-1	-23	-27	-44	-52	17	17	11	16				
40,000	71	51	12	46	45	21	10	-75	-54	-14	-49	-48	-72	-84	27	28	21	26				
30,000	63	43	10	37	37	15	6	-66	-46	-11	-40	-39	-63	-75	24	27	16	27				
20,000	43	30	9	22	23	10	4	-44	-31	-9	-23	-25	-42	-51	20	20	11	19				
BIRMINGHAM TO NEW ORLEANS																			279 N.MI.			
53,000	-38	-25	6	-15	-17	-34	-42	34	23	-7	14	15	0	-8	17	17	11	16				
40,000	-57	-42	0	-32	-33	-56	-68	52	35	-1	28	28	6	-4	27	27	20	24				
30,000	-50	-33	-2	-25	-26	-48	-59	45	28	1	21	22	3	-5	25	26	16	25				
20,000	-31	-21	2	-13	-14	-30	-39	29	19	-2	12	13	-1	-6	19	19	10	18				
BIRMINGHAM TO NEW YORK																			750 N.MI.			
53,000	43	27	2	23	23	9	2	-45	-29	-3	-24	-25	-40	-47	16	15	10	14				
40,000	62	43	17	44	41	21	12	-68	-47	-19	-47	-45	-66	-77	25	25	20	25				
30,000	57	38	16	37	36	17	9	-62	-42	-17	-40	-39	-60	-71	24	25	16	25				
20,000	41	25	12	23	24	11	5	-43	-28	-13	-25	-25	-41	-49	19	19	11	18				
BIRMINGHAM TO PITTSBURGH																			519 N.MI.			
53,000	31	20	0	17	16	3	-3	-35	-22	0	-18	-18	-33	-40	17	16	11	15				
40,000	45	30	8	32	28	9	-1	-55	-36	-11	-37	-34	-55	-66	26	27	21	26				
30,000	41	26	9	27	24	7	-2	-49	-32	-10	-31	-29	-49	-61	25	27	17	27				
20,000	30	17	8	17	16	4	-2	-34	-20	-9	-19	-18	-33	-42	21	20	11	20				
BIRMINGHAM TO WASHINGTON, D.C.																			567 N.MI.			
53,000	43	29	1	22	23	8	1	-46	-30	-1	-23	-25	-41	-48	16	16	11	15				
40,000	64	44	14	44	41	20	10	-69	-49	-16	-47	-45	-67	-79	26	27	20	25				
30,000	57	39	13	36	35	15	7	-62	-42	-14	-39	-38	-60	-71	24	26	16	26				
20,000	41	26	10	22	23	10	4	-43	-28	-11	-24	-24	-40	-49	20	20	11	19				

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**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
BISMARCK TO MINNEAPOLIS																		
53,000	33	20	15	25	22	12	7	-34	-20	-15	-25	-23	-34	-40	17	14	12	14
40,000	49	31	43	41	41	24	15	-51	-33	-45	-43	-43	-60	-70	25	23	23	28
30,000	47	30	37	37	37	19	10	-50	-32	-38	-39	-40	-58	-68	29	28	21	29
20,000	33	22	23	27	26	14	7	-34	-23	-24	-28	-27	-40	-47	21	20	14	20
BOISE TO DENVER																		
53,000	32	21	9	22	20	10	5	-33	-21	-10	-23	-21	-32	-38	16	14	11	14
40,000	47	31	29	35	35	18	9	-49	-33	-32	-37	-37	-55	-64	27	24	22	27
30,000	41	29	24	32	31	14	5	-44	-31	-26	-34	-33	-51	-61	30	27	19	27
20,000	28	19	15	21	20	8	2	-30	-20	-16	-22	-21	-34	-41	21	19	12	18
BOISE TO PORTLAND, ORE.																		
53,000	-30	-18	-11	-22	-20	-31	-37	30	17	10	21	19	9	4	17	15	11	13
40,000	-43	-31	-25	-37	-34	-53	-63	41	29	23	35	32	13	4	28	26	24	29
30,000	-43	-31	-24	-34	-33	-53	-64	40	29	22	32	30	11	0	32	30	23	31
20,000	-28	-19	-16	-22	-21	-35	-43	27	17	16	20	20	6	-1	23	22	15	21
BOISE TO RENO																		
53,000	-13	-13	-13	-12	-13	-22	-27	10	11	13	11	11	2	-4	18	15	11	14
40,000	-21	-16	-27	-21	-22	-40	-49	15	12	25	17	17	-1	-11	28	27	24	29
30,000	-20	-16	-22	-15	-18	-37	-47	14	12	20	10	14	-5	-16	32	29	23	29
20,000	-12	-10	-14	-11	-12	-25	-32	9	8	13	9	10	-3	-11	24	21	14	21
BOISE TO SALT LAKE CITY																		
53,000	27	16	5	18	16	5	0	-29	-17	-6	-19	-17	-28	-35	18	15	11	14
40,000	38	25	18	27	27	8	-1	-42	-28	-22	-31	-30	-49	-59	29	26	24	29
30,000	35	24	15	27	24	5	-5	-39	-27	-18	-30	-27	-47	-58	32	30	22	29
20,000	24	15	10	17	16	3	-4	-26	-17	-11	-18	-17	-31	-38	23	21	14	20
BOISE TO SAN FRANCISCO																		
53,000	-15	-15	-14	-14	-14	-23	-29	13	13	13	12	13	4	-1	17	14	11	13
40,000	-25	-19	-29	-23	-24	-41	-51	19	15	27	19	20	3	-7	27	26	23	27
30,000	-23	-18	-22	-17	-20	-38	-48	17	14	20	13	16	-2	-12	31	28	22	28
20,000	-14	-11	-14	-12	-13	-25	-32	11	10	13	10	11	-1	-8	23	21	13	19
BOISE TO SEATTLE																		
53,000	-28	-14	-7	-18	-16	-27	-33	27	14	7	18	15	5	0	17	14	11	13
40,000	-38	-26	-19	-33	-28	-47	-57	35	24	16	30	26	8	-2	27	25	23	29
30,000	-38	-26	-19	-30	-28	-48	-59	34	23	16	27	24	5	-5	31	30	23	30
20,000	-25	-15	-12	-19	-17	-31	-39	23	14	11	17	16	2	-5	22	21	15	21
BOSTON TO BUFFALO																		
53,000	-45	-29	-14	-29	-28	-41	-49	44	28	14	28	27	15	9	18	16	12	15
40,000	-72	-48	-41	-52	-52	-73	-84	69	46	39	50	50	31	21	29	28	25	29
30,000	-69	-46	-37	-46	-48	-70	-82	66	44	35	44	46	26	16	33	31	22	30
20,000	-46	-32	-25	-31	-32	-48	-57	45	30	24	30	31	17	10	23	23	14	22
BOSTON TO CHICAGO																		
53,000	-45	-29	-13	-29	-28	-41	-48	44	28	13	28	27	16	10	16	14	11	14
40,000	-72	-48	-40	-51	-52	-71	-81	70	46	38	49	50	32	23	26	24	22	25
30,000	-69	-45	-35	-46	-47	-67	-78	67	43	34	44	45	27	19	28	27	19	26
20,000	-47	-30	-24	-31	-31	-46	-54	45	29	23	30	31	18	12	21	20	12	20
BOSTON TO CLEVELAND																		
53,000	-47	-29	-13	-30	-28	-42	-50	46	29	12	29	28	15	9	17	16	12	15
40,000	-74	-49	-39	-53	-53	-73	-84	72	47	37	51	51	32	22	28	27	23	27
30,000	-71	-46	-35	-47	-48	-69	-81	68	44	33	45	46	27	17	30	29	20	28
20,000	-48	-31	-23	-32	-32	-48	-57	47	30	23	31	31	18	11	22	22	13	21
BOSTON TO DALLAS																		
53,000	-46	-31	-6	-26	-27	-40	-47	45	30	5	25	26	12	6	14	13	9	12
40,000	-73	-50	-25	-48	-48	-67	-78	69	47	23	45	45	28	19	22	21	17	21
30,000	-66	-45	-20	-41	-41	-61	-71	63	42	19	38	38	22	14	22	22	14	22
20,000	-44	-29	-15	-26	-27	-41	-48	42	27	14	24	25	14	9	17	16	9	16
BOSTON TO DENVER																		
53,000	-41	-28	-13	-27	-26	-37	-43	40	27	13	26	26	16	11	13	11	9	11
40,000	-69	-45	-40	-47	-49	-65	-73	66	44	39	45	47	33	26	20	19	17	20
30,000	-62	-42	-33	-42	-43	-59	-68	60	39	32	39	41	27	20	22	21	14	21
20,000	-41	-28	-22	-28	-28	-40	-47	40	27	21	27	27	18	13	16	16	10	15

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEAD WINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
BOSTON TO DETROIT															548 N.MI.			
53,000	-46	-29	-13	-29	-28	-42	-49	45	28	13	29	28	15	10	17	15	12	14
40,000	-73	-49	-40	-52	-53	-72	-83	71	47	38	50	51	32	22	27	26	23	27
30,000	-70	-46	-35	-47	-48	-69	-80	68	43	34	44	46	27	18	29	29	20	28
20,000	-47	-31	-24	-32	-32	-47	-56	46	30	24	30	31	18	11	22	22	13	21
BOSTON TO LOS ANGELES															2263 N.MI.			
53,000	-39	-29	-11	-24	-25	-35	-40	38	28	11	24	25	15	11	11	10	7	9
40,000	-64	-45	-37	-44	-46	-60	-67	61	42	36	41	44	32	26	18	16	14	17
30,000	-57	-41	-29	-37	-39	-53	-61	54	38	28	35	37	26	20	19	18	12	17
20,000	-37	-26	-19	-24	-25	-35	-41	35	25	19	23	24	16	12	14	13	8	12
BOSTON TO MIAMI															1094 N.MI.			
53,000	-23	-12	2	-12	-10	-22	-28	18	9	-2	10	8	-2	-7	14	14	9	14
40,000	-34	-27	-4	-25	-22	-38	-47	23	19	2	20	16	1	-7	22	22	17	21
30,000	-29	-20	-6	-21	-18	-32	-41	21	14	4	17	13	0	-6	21	21	14	20
20,000	-21	-14	-7	-14	-13	-23	-29	17	11	6	13	11	2	-3	16	16	9	14
BOSTON TO MONTREAL															221 N.MI.			
53,000	-21	-16	-11	-13	-15	-26	-32	17	14	10	11	13	2	-3	19	16	13	16
40,000	-37	-27	-26	-26	-29	-49	-59	26	22	22	18	22	3	-8	30	28	26	30
30,000	-35	-28	-24	-23	-27	-48	-59	24	22	20	16	21	0	-11	36	33	23	31
20,000	-21	-19	-15	-15	-17	-32	-40	16	16	14	12	14	0	-8	25	24	15	23
BOSTON TO PHILADELPHIA															242 N.MI.			
53,000	-41	-23	-8	-27	-23	-38	-46	39	21	7	26	22	9	3	19	17	12	16
40,000	-62	-42	-30	-49	-45	-66	-78	56	38	27	45	41	20	10	30	29	25	30
30,000	-60	-40	-28	-42	-41	-63	-75	54	35	26	39	37	17	7	33	32	21	30
20,000	-43	-26	-19	-29	-28	-44	-53	40	24	18	27	26	12	4	24	24	14	23
BOSTON TO PITTSBURGH															430 N.MI.			
53,000	-47	-29	-11	-30	-28	-43	-50	46	28	11	29	27	14	8	18	16	12	15
40,000	-73	-49	-37	-53	-52	-73	-84	70	47	35	51	50	30	20	28	27	24	28
30,000	-70	-46	-33	-47	-47	-69	-81	67	43	32	45	45	26	16	30	30	20	29
20,000	-48	-31	-23	-32	-32	-47	-57	47	29	22	30	30	17	10	23	22	13	22
BOSTON TO SAN FRANCISCO															2343 N.MI.			
53,000	-36	-25	-14	-24	-24	-33	-38	35	25	14	24	24	16	12	11	9	7	9
40,000	-58	-40	-41	-43	-45	-57	-64	56	38	40	41	43	32	26	17	16	14	17
30,000	-54	-38	-34	-38	-40	-52	-59	51	35	32	35	37	26	20	19	17	12	17
20,000	-35	-25	-21	-25	-26	-34	-40	33	23	21	24	25	17	13	14	13	8	12
BOSTON TO SYRACUSE															230 N.MI.			
53,000	-44	-28	-14	-28	-27	-41	-49	43	27	14	28	27	14	9	19	17	13	16
40,000	-70	-48	-40	-51	-52	-72	-84	67	46	39	48	49	29	19	30	29	26	30
30,000	-68	-46	-37	-45	-47	-69	-82	64	43	36	42	45	25	14	34	32	23	30
20,000	-45	-32	-25	-31	-32	-47	-56	43	30	24	29	31	16	9	24	24	15	23
BOSTON TO TAMPA															1031 N.MI.			
53,000	-31	-18	1	-16	-15	-28	-34	26	15	-2	14	13	1	-4	14	14	9	14
40,000	-44	-34	-8	-33	-29	-47	-57	35	27	6	28	23	7	-1	22	23	17	22
30,000	-40	-27	-9	-28	-25	-41	-50	32	21	7	24	20	6	-1	21	22	14	21
20,000	-28	-18	-8	-18	-17	-29	-36	25	16	8	16	15	5	0	17	17	9	15
BOSTON TO WASHINGTON, D.C.															346 N.MI.			
53,000	-42	-24	-7	-27	-24	-39	-47	40	22	6	26	22	9	3	18	17	12	16
40,000	-63	-43	-29	-49	-45	-66	-77	56	38	26	45	41	21	11	29	29	24	29
30,000	-61	-40	-27	-42	-41	-62	-74	54	36	25	39	37	18	8	31	31	20	29
20,000	-43	-26	-18	-28	-27	-43	-52	40	24	17	27	26	12	5	23	23	13	22
BUFFALO TO CHICAGO															410 N.MI.			
53,000	-44	-28	-13	-28	-27	-40	-48	43	28	12	28	27	14	9	17	16	12	15
40,000	-71	-47	-39	-49	-51	-71	-82	69	45	37	47	49	30	20	28	26	23	28
30,000	-68	-43	-33	-45	-46	-67	-78	65	41	32	43	44	25	15	29	29	20	29
20,000	-46	-29	-23	-30	-30	-46	-54	44	27	22	29	29	16	9	23	22	14	22
BUFFALO TO DETROIT															208 N.MI.			
53,000	-44	-28	-12	-29	-27	-41	-49	44	27	12	28	27	14	8	18	16	13	16
40,000	-71	-47	-38	-50	-51	-72	-83	69	45	36	48	49	29	19	29	28	25	29
30,000	-69	-43	-33	-46	-46	-68	-80	66	40	32	44	44	24	14	30	31	22	30
20,000	-46	-28	-23	-31	-31	-47	-55	45	27	22	29	29	15	8	24	24	14	23

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*													STANDARD DEVIATION				
	D I R E C T								R E T U R N					JAN	APR	JUL	OCT	
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75					A85
BUFFALO TO NEW YORK																		
53,000	36	25	13	22	23	11	5	-39	-26	-13	-23	-24	-37	-45	18	17	13	16
40,000	58	40	34	38	42	22	12	-64	-43	-36	-42	-46	-66	-78	30	29	25	29
30,000	56	38	29	33	38	18	8	-62	-42	-31	-38	-41	-63	-75	32	31	21	30
20,000	37	28	20	23	26	12	5	-41	-30	-21	-25	-28	-43	-52	24	23	14	23
BUFFALO TO PHILADLLPHIA																		
53,000	25	20	11	15	17	6	0	-29	-21	-11	-17	-19	-31	-37	19	17	13	16
40,000	43	30	27	25	31	12	1	-52	-35	-30	-31	-37	-57	-68	30	29	25	29
30,000	41	29	21	22	28	9	-1	-50	-34	-24	-28	-33	-54	-65	31	31	21	30
20,000	27	23	15	15	19	6	-2	-32	-25	-16	-18	-22	-37	-45	24	23	14	23
BUFFALO TO TAMPA																		
53,000	-16	-7	3	-8	-6	-17	-23	10	4	-4	5	3	-6	-11	14	14	10	14
40,000	-23	-16	1	-18	-13	-30	-38	9	7	-4	12	6	-9	-17	23	23	18	23
30,000	-20	-11	-2	-15	-11	-26	-34	9	4	0	10	5	-8	-15	20	23	15	22
20,000	-15	-6	-3	-9	-7	-18	-24	9	3	2	7	5	-5	-10	17	17	10	16
BUFFALO TO WASHINGTON, D.C.																		
53,000	6	9	7	3	6	-4	-10	-12	-11	-8	-6	-9	-20	-26	19	17	13	16
40,000	15	12	14	4	11	-7	-18	-29	-19	-18	-12	-20	-38	-49	29	29	24	29
30,000	15	12	9	4	10	-8	-19	-28	-19	-12	-11	-17	-36	-47	30	31	20	30
20,000	10	12	7	3	8	-6	-13	-16	-15	-8	-6	-11	-25	-33	24	23	14	23
BURBANK TO SAN FRANCISCO																		
53,000	-27	-19	-2	-14	-14	-27	-34	25	17	1	13	13	2	-4	19	16	12	14
40,000	-40	-33	-12	-24	-27	-46	-56	36	30	8	21	23	5	-5	29	27	22	26
30,000	-34	-31	-10	-20	-23	-42	-53	31	28	8	18	20	2	-7	31	28	21	26
20,000	-23	-16	-6	-10	-12	-26	-34	21	15	5	9	11	-1	-8	23	21	13	18
CALGARY TO GREAT FALLS																		
53,000	20	7	3	13	10	0	-4	-21	-8	-4	-14	-11	-21	-27	17	13	11	13
40,000	26	11	8	14	14	-3	-11	-29	-13	-11	-17	-17	-34	-43	24	23	23	27
30,000	22	12	7	18	14	-4	-14	-26	-15	-10	-22	-18	-37	-47	28	27	23	30
20,000	19	9	6	15	12	-1	-7	-21	-10	-8	-17	-14	-27	-34	20	19	15	20
CALGARY TO REGINA																		
53,000	28	16	15	24	20	11	7	-29	-17	-15	-25	-21	-30	-36	16	12	10	12
40,000	37	23	29	30	30	14	6	-38	-24	-31	-32	-31	-47	-55	22	21	22	25
30,000	40	23	27	34	31	14	4	-42	-25	-28	-37	-32	-50	-60	26	25	21	29
20,000	28	18	18	25	22	10	4	-29	-18	-19	-26	-23	-35	-41	19	17	14	19
CALGARY TO SASKATOON																		
53,000	24	16	14	22	19	10	5	-25	-16	-15	-23	-19	-29	-34	16	13	11	13
40,000	30	21	27	28	27	11	3	-32	-22	-29	-30	-28	-44	-52	22	21	22	25
30,000	35	20	26	31	28	11	1	-37	-22	-27	-34	-30	-48	-57	26	26	22	29
20,000	23	16	17	21	19	7	1	-24	-17	-17	-22	-20	-32	-39	19	18	15	19
CALGARY TO TORONTO																		
53,000	32	18	15	24	21	14	10	-33	-19	-15	-25	-22	-30	-35	12	10	8	10
40,000	45	28	37	36	37	24	18	-47	-30	-39	-38	-39	-51	-58	17	16	16	20
30,000	45	29	33	36	35	22	15	-48	-31	-34	-38	-37	-51	-59	20	20	16	21
20,000	32	21	22	26	25	16	11	-33	-22	-23	-27	-26	-36	-41	15	14	10	15
CALGARY TO VANCOUVER																		
53,000	-23	-16	-13	-24	-19	-28	-34	22	16	13	23	18	9	4	16	14	11	12
40,000	-32	-23	-20	-34	-27	-43	-52	29	21	18	32	25	9	0	24	22	23	25
30,000	-36	-25	-25	-36	-30	-49	-59	33	23	23	34	28	10	0	28	28	24	29
20,000	-25	-17	-16	-25	-21	-34	-41	24	16	16	24	20	7	0	21	20	15	20
CASPER TO DENVER																		
53,000	15	8	0	11	8	-3	-8	-18	-10	-1	-13	-9	-21	-27	18	16	12	15
40,000	22	11	5	15	13	-6	-15	-30	-15	-10	-20	-18	-37	-48	29	26	24	29
30,000	18	10	5	16	11	-7	-17	-25	-14	-8	-20	-16	-35	-46	32	30	20	29
20,000	15	8	3	11	9	-4	-11	-18	-10	-4	-13	-10	-24	-32	23	21	13	20
CASPER TO SALT LAKE CITY																		
53,000	-28	-21	-15	-17	-20	-30	-36	26	20	14	18	19	9	4	18	15	11	15
40,000	-42	-31	-41	-36	-37	-56	-65	38	29	39	33	35	17	7	29	26	23	28
30,000	-38	-30	-33	-29	-32	-51	-61	33	27	32	26	30	11	1	32	29	20	28
20,000	-24	-19	-20	-19	-20	-32	-39	22	17	19	17	19	7	0	22	20	13	19

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HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	DIRECT								RETURN								JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85		JAN	APR	JUL	OCT	A50	A75	A85		JAN	APR	JUL	OCT
CHARLESTON, S.C. TO NORFOLK																	305 N.MI.			
53,000	31	20	-3	15	15	1	-5		-35	-23	2	-17	-17	-33	-41		17	18	11	17
40,000	41	32	5	33	27	7	-3		-51	-39	-7	-36	-33	-55	-66		27	29	21	27
30,000	37	27	7	28	23	6	-3		-45	-32	-8	-31	-28	-48	-59		24	27	17	27
20,000	30	19	8	17	17	5	-1		-33	-22	-8	-19	-19	-33	-42		20	20	11	19
CHARLESTON, W.VA. TO HUNTSVILLE																	326 N.MI.			
53,000	-41	-27	-1	-21	-22	-38	-46		38	25	0	19	20	5	-1		18	17	11	16
40,000	-64	-44	-14	-42	-40	-63	-75		57	38	11	39	35	14	4		28	28	22	27
30,000	-57	-38	-11	-35	-34	-56	-68		51	33	10	32	30	11	2		26	28	17	28
20,000	-39	-25	-10	-21	-22	-38	-47		37	22	9	19	20	7	0		21	21	12	20
CHARLESTON, W.VA. TO NEW YORK																	386 N.MI.			
53,000	48	29	8	28	27	13	6		-49	-30	-8	-29	-28	-44	-52		18	17	12	16
40,000	71	48	29	50	49	28	18		-75	-51	-32	-53	-51	-73	-85		28	28	23	28
30,000	67	44	26	44	44	24	15		-71	-47	-28	-46	-46	-68	-81		28	29	19	29
20,000	47	29	19	29	29	15	9		-49	-31	-19	-30	-30	-47	-57		22	22	13	22
CHARLESTON, W.VA. TO WASHINGTON, D.C.																	216 N.MI.			
53,000	51	33	8	28	29	13	6		-51	-33	-8	-29	-29	-46	-54		18	18	12	16
40,000	77	52	29	51	51	29	19		-79	-54	-31	-53	-53	-76	-89		29	29	24	29
30,000	71	47	25	44	45	24	15		-73	-49	-26	-46	-47	-70	-83		27	30	19	30
20,000	49	32	18	28	30	15	9		-50	-33	-18	-30	-31	-48	-58		23	23	13	22
CHARLOTTE TO CHATTANOOGA																	210 N.MI.			
53,000	-54	-38	-3	-26	-30	-48	-56		53	37	3	25	29	10	3		18	18	11	17
40,000	-80	-59	-19	-52	-52	-77	-90		78	56	17	50	50	25	14		28	30	22	28
30,000	-71	-50	-14	-42	-43	-68	-80		69	48	13	40	41	18	8		25	28	17	29
20,000	-46	-34	-11	-24	-27	-45	-54		45	33	10	23	26	11	5		21	21	12	20
CHARLOTTE TO CHICAGO																	521 N.MI.			
53,000	-31	-22	-9	-17	-19	-31	-37		27	20	9	15	17	6	1		17	16	11	15
40,000	-52	-36	-25	-31	-35	-54	-64		42	30	23	25	29	12	3		27	26	22	27
30,000	-47	-32	-18	-26	-30	-49	-59		39	27	17	21	25	9	0		26	27	17	27
20,000	-30	-22	-12	-18	-19	-33	-41		25	20	11	16	17	5	-1		21	21	12	20
CHARLOTTE TO CLEVELAND																	374 N.MI.			
53,000	-4	-6	-6	-2	-4	-15	-20		-2	2	6	-1	2	-9	-15		18	17	12	16
40,000	-16	-10	-12	-2	-10	-28	-38		1	2	9	-6	2	-16	-26		28	28	22	28
30,000	-15	-9	-6	-2	-8	-24	-34		1	2	3	-5	1	-16	-25		26	28	18	28
20,000	-6	-9	-3	-1	-4	-17	-24		0	5	2	-2	1	-11	-19		22	22	12	21
CHARLOTTE TO COLUMBUS, OHIO																	302 N.MI.			
53,000	-15	-12	-8	-8	-10	-21	-27		9	9	7	5	8	-3	-9		18	17	12	16
40,000	-30	-21	-16	-12	-20	-38	-48		16	13	14	5	12	-6	-16		28	28	23	28
30,000	-27	-18	-10	-11	-16	-34	-44		15	11	8	4	10	-7	-16		26	29	18	29
20,000	-14	-14	-6	-7	-9	-23	-30		8	11	5	4	6	-6	-13		22	22	12	21
CHARLOTTE TO JACKSONVILLE																	290 N.MI.			
53,000	-10	-4	5	-4	-3	-14	-20		4	0	-5	2	0	-11	-16		16	17	11	17
40,000	-17	-12	5	-13	-8	-27	-36		4	2	-7	7	1	-16	-25		26	28	20	26
30,000	-14	-6	2	-10	-6	-22	-31		4	-1	-2	6	1	-13	-21		23	26	16	25
20,000	-12	-5	-2	-7	-6	-17	-24		7	2	1	5	3	-7	-13		19	19	10	18
CHARLOTTE TO MIAMI																	567 N.MI.			
53,000	0	5	3	1	2	-7	-13		-6	-8	-3	-3	-5	-14	-20		15	16	10	16
40,000	-3	-1	7	-2	1	-15	-23		-9	-8	-8	-3	-7	-22	-30		23	25	18	24
30,000	-1	5	4	-2	2	-11	-18		-7	-11	-4	-2	-6	-19	-26		19	22	14	21
20,000	-1	1	-2	-3	-1	-10	-16		-2	-4	2	1	0	-10	-15		17	16	9	15
CHARLOTTE TO NEW YORK																	469 N.MI.			
53,000	58	22	2	21	20	6	0		-41	-25	-2	-23	-22	-37	-45		17	17	11	15
40,000	51	37	16	41	35	16	6		-60	-42	-18	-45	-41	-61	-73		27	28	22	27
30,000	48	33	16	35	31	14	5		-55	-38	-17	-38	-36	-56	-68		26	28	18	27
20,000	37	22	12	23	22	9	3		-40	-24	-13	-24	-24	-39	-48		21	21	12	20
CHARLOTTE TO PHILADELPHIA																	389 N.MI.			
53,000	37	22	1	20	19	5	-1		-40	-24	-1	-22	-21	-37	-44		17	17	12	16
40,000	47	35	13	40	34	14	4		-58	-41	-16	-44	-39	-60	-72		27	28	22	28
30,000	46	32	14	34	30	12	3		-54	-37	-15	-37	-34	-55	-66		26	28	18	28
20,000	35	21	11	22	23	8	1		-39	-23	-12	-23	-22	-38	-47		21	21	12	20

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
CHARLOTTE TO RICHMOND																		
53,000	41	27	0	21	22	6	-1	-44	-29	-1	-22	-23	-40	-48	17	18	12	17
40,000	58	42	13	43	38	16	6	-65	-47	-15	-47	-43	-66	-78	28	29	22	28
30,000	53	37	13	36	33	14	4	-59	-41	-14	-39	-37	-59	-71	25	29	18	28
20,000	39	25	11	22	22	9	2	-42	-27	-11	-24	-24	-40	-50	22	22	12	21
CHARLOTTE TO WASHINGTON, D.C.																		
53,000	34	21	0	18	17	3	-3	-38	-23	0	-20	-20	-35	-43	17	18	12	16
40,000	46	33	10	37	31	11	0	-56	-39	-13	-42	-37	-58	-70	28	29	22	28
30,000	42	29	11	32	27	9	0	-51	-35	-13	-36	-32	-53	-64	25	29	18	28
20,000	33	19	10	20	19	6	-1	-37	-22	-10	-22	-21	-36	-46	22	22	12	21
CHATTANOOGA TO CINCINNATI																		
53,000	4	2	-5	3	0	-10	-16	-10	-5	4	-5	-3	-15	-22	18	17	12	16
40,000	5	1	-6	6	1	-17	-26	-20	-10	3	-13	-10	-29	-39	28	29	23	28
30,000	5	1	-2	5	2	-15	-24	-17	-9	1	-11	-8	-26	-36	27	29	18	29
20,000	7	0	0	3	2	-10	-17	-13	-4	-1	-5	-5	-18	-26	22	22	12	21
CHATTANOOGA TO MEMPHIS																		
53,000	-53	-38	-3	-26	-30	-48	-56	52	37	3	25	29	11	3	18	18	11	16
40,000	-80	-58	-19	-51	-51	-76	-89	78	56	17	49	49	25	14	28	29	22	27
30,000	-70	-49	-13	-41	-41	-67	-79	68	47	12	39	40	17	7	28	28	17	30
20,000	-45	-34	-10	-24	-26	-44	-53	44	33	9	23	25	10	4	22	21	11	20
CHATTANOOGA TO WASHINGTON, D.C.																		
53,000	45	29	2	24	24	9	2	-47	-31	-3	-25	-26	-42	-50	17	17	11	15
40,000	66	46	17	46	43	22	12	-71	-50	-19	-44	-47	-69	-81	27	28	21	27
30,000	60	40	15	39	37	17	9	-65	-44	-17	-41	-40	-63	-74	25	27	17	27
20,000	43	27	12	24	24	11	5	-45	-29	-13	-25	-26	-42	-51	21	21	12	20
CHICAGO TO CINCINNATI																		
53,000	26	19	10	16	17	6	1	-30	-21	-11	-18	-19	-31	-38	19	17	12	16
40,000	43	29	27	27	31	12	2	-52	-34	-30	-33	-37	-56	-67	29	27	24	30
30,000	40	27	20	24	27	9	-1	-48	-32	-22	-29	-32	-52	-63	30	30	20	30
20,000	28	20	13	19	19	6	-1	-32	-22	-14	-21	-21	-36	-45	23	23	14	22
CHICAGO TO CLEVELAND																		
53,000	44	29	13	27	27	15	9	-45	-30	-13	-28	-28	-41	-49	18	16	12	15
40,000	70	46	38	47	50	30	20	-72	-48	-40	-49	-52	-72	-83	29	27	24	29
30,000	66	43	32	42	44	25	15	-68	-45	-33	-45	-46	-67	-79	30	30	20	30
20,000	45	29	22	29	30	16	9	-46	-30	-22	-30	-31	-47	-56	23	23	14	22
CHICAGO TO COLUMBUS, OHIO																		
53,000	39	26	12	24	24	12	6	-41	-28	-13	-25	-25	-38	-46	18	17	12	16
40,000	63	42	35	41	44	25	15	-67	-45	-37	-44	-48	-68	-79	29	27	24	29
30,000	59	39	28	36	39	20	10	-63	-42	-29	-40	-42	-63	-75	30	30	20	30
20,000	41	27	19	26	27	13	6	-43	-29	-20	-27	-28	-44	-53	23	23	14	22
CHICAGO TO DALLAS																		
53,000	-31	-23	-2	-16	-17	-30	-37	27	21	2	15	15	4	-2	16	15	11	14
40,000	-55	-37	-14	-31	-33	-53	-63	46	31	11	26	27	10	1	26	24	20	25
30,000	-47	-31	-10	-25	-26	-46	-58	40	27	8	20	22	5	-3	27	25	16	26
20,000	-29	-19	-9	-14	-16	-29	-37	25	17	9	12	14	3	-2	20	19	11	18
CHICAGO TO DAYTON																		
53,000	34	24	12	21	22	10	4	-37	-25	-12	-22	-23	-36	-43	19	17	12	16
40,000	55	37	33	36	40	21	11	-62	-41	-35	-40	-44	-64	-75	29	27	24	30
30,000	52	35	25	32	35	16	6	-58	-38	-27	-36	-38	-59	-71	30	30	20	30
20,000	36	24	17	24	24	10	3	-39	-26	-18	-25	-26	-41	-50	23	23	14	23
CHICAGO TO DENVER																		
53,000	-34	-28	-13	-25	-25	-37	-43	38	27	12	24	24	14	9	16	14	10	13
40,000	-67	-44	-40	-44	-48	-65	-75	65	42	38	41	46	29	21	25	23	20	25
30,000	-57	-39	-31	-38	-40	-58	-67	54	37	30	36	38	22	14	27	25	17	25
20,000	-37	-26	-20	-26	-26	-39	-46	35	25	20	24	25	14	8	20	19	11	18
CHICAGO TO DES MOINES																		
53,000	-42	-29	-13	-26	-26	-40	-47	41	28	12	26	26	14	8	18	16	12	15
40,000	-64	-46	-39	-47	-50	-69	-81	67	45	34	45	48	28	19	28	26	24	30
30,000	-63	-42	-31	-42	-43	-64	-76	61	40	30	40	41	22	12	31	29	20	30
20,000	-42	-28	-22	-28	-29	-43	-52	40	26	21	27	27	14	7	23	22	14	22

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HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
CHICAGO TO DETROIT																		
53,000	43	28	12	27	27	14	8	-44	-29	-13	-28	-27	-41	-49	18	16	13	16
40,000	69	46	38	47	49	29	19	-71	-48	-39	-49	-51	-71	-83	29	27	24	30
30,000	65	41	32	42	43	24	14	-67	-44	-33	-45	-45	-67	-79	31	30	21	30
20,000	44	27	22	29	29	15	8	-45	-29	-23	-30	-30	-46	-55	24	23	14	24
CHICAGO TO EVANSVILLE																		
53,000	0	1	5	0	2	-9	-15	-5	-4	-5	-3	-4	-15	-20	19	17	12	16
40,000	-3	0	7	-1	1	-18	-28	-11	-7	-11	-6	-9	-27	-37	29	27	24	29
30,000	-2	1	5	-1	1	-17	-28	-10	-7	-7	-5	-8	-26	-36	30	29	20	30
20,000	0	2	1	3	2	-11	-19	-6	-5	-3	-6	-5	-18	-26	23	23	13	22
CHICAGO TO FORT LAUDERDALE																		
53,000	14	13	5	8	9	1	-3	-20	-16	-5	-9	-12	-22	-27	14	14	9	13
40,000	18	17	12	12	14	1	-6	-30	-25	-14	-18	-21	-36	-44	22	22	17	21
30,000	16	17	8	10	12	0	-7	-26	-23	-9	-14	-17	-31	-38	20	21	14	21
20,000	11	11	3	6	7	-2	-7	-15	-13	-4	-8	-9	-19	-25	16	16	9	15
CHICAGO TO GREENSBORO																		
53,000	31	23	10	18	19	9	3	-35	-25	-10	-20	-21	-33	-41	17	16	11	15
40,000	50	35	27	30	35	17	8	-59	-40	-29	-35	-40	-59	-70	27	26	22	27
30,000	47	32	20	26	30	13	4	-54	-36	-21	-31	-34	-54	-65	26	27	18	28
20,000	31	23	13	19	20	8	2	-35	-25	-14	-21	-22	-37	-45	21	21	12	20
CHICAGO TO HARRISBURG																		
53,000	44	29	13	27	27	15	9	-45	-30	-13	-28	-28	-41	-49	17	16	12	15
40,000	71	47	38	46	50	31	21	-74	-49	-39	-49	-52	-72	-83	27	26	23	27
30,000	67	43	31	42	44	26	16	-70	-46	-32	-44	-46	-67	-79	28	28	19	28
20,000	46	30	21	28	30	17	10	-48	-31	-22	-30	-31	-46	-56	22	22	13	21
CHICAGO TO HARTFORD																		
53,000	45	29	13	28	27	16	10	-45	-29	-13	-29	-28	-41	-48	16	15	11	14
40,000	71	47	38	49	50	32	23	-73	-49	-40	-51	-52	-71	-82	26	25	22	26
30,000	67	43	33	44	45	27	18	-70	-46	-34	-46	-47	-67	-79	28	27	19	27
20,000	46	29	23	29	31	18	11	-47	-31	-23	-31	-32	-46	-55	21	21	13	20
CHICAGO TO HONOLULU																		
53,000	-25	-22	-12	-18	-19	-25	-29	23	21	11	17	18	12	9	9	8	6	8
40,000	-43	-34	-30	-32	-34	-44	-49	40	32	29	30	32	24	19	14	13	11	12
30,000	-36	-29	-22	-26	-27	-36	-42	33	26	21	24	25	17	13	14	13	9	12
20,000	-22	-16	-11	-15	-15	-22	-26	21	15	10	14	14	9	6	10	9	6	8
CHICAGO TO HOUSTON																		
53,000	-25	-18	2	-11	-12	-24	-31	20	15	-2	10	10	-1	-6	16	14	10	13
40,000	-45	-29	-5	-23	-25	-43	-54	34	22	3	18	18	1	-7	25	24	19	23
30,000	-39	-24	-3	-18	-19	-38	-49	30	19	2	14	14	-1	-9	25	24	15	24
20,000	-24	-15	-3	-9	-11	-24	-31	19	12	2	7	9	-2	-7	18	18	10	17
CHICAGO TO KANSAS CITY																		
53,000	-39	-27	-9	-23	-23	-37	-44	37	26	9	22	22	10	4	18	16	12	15
40,000	-65	-43	-31	-42	-44	-64	-75	60	40	28	38	41	22	12	28	26	23	29
30,000	-58	-39	-24	-37	-37	-58	-70	53	35	22	33	34	16	6	31	29	19	29
20,000	-37	-25	-18	-23	-24	-39	-47	35	23	17	21	23	10	3	22	22	13	21
CHICAGO TO LAS VEGAS																		
53,000	-36	-28	-12	-23	-24	-34	-40	35	27	11	22	23	13	9	14	12	9	11
40,000	-61	-42	-38	-41	-45	-60	-68	58	40	36	39	43	28	21	22	20	17	21
30,000	-51	-38	-29	-35	-37	-52	-61	48	36	28	32	35	21	14	24	22	14	21
20,000	-33	-24	-18	-22	-23	-34	-40	31	23	18	20	22	13	8	17	16	10	15
CHICAGO TO LOS ANGELES																		
53,000	-36	-28	-11	-22	-23	-34	-39	34	27	10	21	23	13	9	13	11	8	11
40,000	-59	-42	-36	-40	-44	-58	-66	56	40	35	37	41	28	21	21	19	16	20
30,000	-50	-38	-27	-33	-36	-50	-58	47	35	26	31	33	21	14	23	20	13	19
20,000	-32	-24	-17	-20	-22	-32	-38	30	23	17	19	21	12	8	16	15	9	14
CHICAGO TO LOUISVILLE																		
53,000	15	11	8	9	10	0	-5	-20	-14	-9	-11	-13	-24	-30	19	17	12	16
40,000	23	17	18	14	18	0	-10	-35	-23	-22	-21	-25	-44	-54	29	27	24	29
30,000	21	16	13	13	15	-2	-12	-32	-22	-16	-19	-21	-40	-51	30	29	19	30
20,000	16	12	8	12	11	-2	-9	-21	-15	-9	-14	-14	-28	-36	23	23	13	22

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*							STANDARD DEVIATION			
	D I R E C T								R E T U R N										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT	
CHICAGO TO MEMPHIS 426 N.MI.																			
53,000	-14	-9	2	-7	-6	-18	-24	8	6	-3	5	4	-6	-12	18	16	11	15	
40,000	-28	-16	-2	-15	-15	-34	-44	15	8	-2	8	7	-11	-20	28	26	22	27	
30,000	-25	-13	-2	-13	-12	-31	-41	14	7	0	7	6	-11	-20	29	28	18	29	
20,000	-15	-8	-3	-5	-7	-20	-28	10	5	2	3	4	-8	-14	22	21	12	20	
CHICAGO TO MIAMI 1041 N.MI.																			
53,000	14	13	5	7	9	1	-4	-19	-16	-5	-9	-12	-21	-27	14	14	9	13	
40,000	17	16	12	11	14	0	-7	-29	-24	-13	-17	-20	-35	-43	22	22	17	21	
30,000	16	16	8	9	12	0	-7	-25	-22	-9	-14	-17	-30	-38	20	21	13	21	
20,000	10	10	3	6	7	-2	-7	-14	-13	-4	-7	-9	-19	-25	16	16	9	15	
CHICAGO TO MINNEAPOLIS 290 N.MI.																			
53,000	-35	-22	-13	-23	-22	-34	-40	33	20	13	22	21	11	5	18	16	12	15	
40,000	-54	-36	-40	-41	-42	-61	-71	49	33	37	38	39	21	11	27	25	24	29	
30,000	-51	-35	-33	-37	-38	-58	-68	45	32	31	34	35	17	7	31	29	21	30	
20,000	-36	-23	-21	-26	-26	-40	-48	33	22	20	24	24	11	4	23	22	14	22	
CHICAGO TO MONTREAL 647 N.MI.																			
53,000	39	25	12	26	25	14	8	-40	-25	-13	-27	-25	-37	-44	16	14	12	14	
40,000	63	41	36	45	46	28	19	-66	-43	-38	-48	-48	-66	-77	26	24	22	26	
30,000	60	36	32	41	41	23	14	-64	-39	-34	-44	-44	-63	-74	29	28	20	27	
20,000	40	24	22	28	28	15	8	-42	-26	-23	-29	-29	-43	-51	21	21	13	21	
CHICAGO TO NASHVILLE 356 N.MI.																			
53,000	3	4	6	3	4	-6	-12	-9	-7	-6	-5	-7	-17	-23	18	16	12	15	
40,000	3	4	10	2	5	-13	-23	-17	-12	-13	-10	-13	-31	-40	28	27	23	28	
30,000	3	4	7	2	4	-13	-23	-15	-11	-9	-8	-11	-28	-38	29	28	18	29	
20,000	3	4	3	5	4	-9	-16	-9	-8	-4	-7	-6	-19	-27	22	22	13	21	
CHICAGO TO NEW ORLEANS 728 N.MI.																			
53,000	-13	-7	4	-5	-4	-15	-21	7	4	-5	3	2	-8	-12	16	15	10	14	
40,000	-27	-13	2	-11	-11	-29	-38	13	4	-5	5	4	-12	-20	25	25	20	23	
30,000	-23	-10	1	-9	-9	-26	-36	12	4	-2	4	3	-11	-19	25	25	16	25	
20,000	-14	-6	0	-4	-5	-17	-24	9	3	-1	1	2	-8	-14	19	18	10	18	
CHICAGO TO NEW YORK 641 N.MI.																			
53,000	45	29	13	28	27	15	10	-46	-30	-13	-28	-28	-42	-49	17	15	11	14	
40,000	72	47	38	48	50	32	23	-74	-49	-39	-50	-52	-72	-82	26	25	22	26	
30,000	68	44	32	43	45	27	18	-70	-46	-33	-45	-47	-67	-79	27	27	19	27	
20,000	46	30	22	29	30	17	11	-48	-32	-23	-30	-31	-46	-55	21	21	12	20	
CHICAGO TO OMAHA 405 N.MI.																			
53,000	-41	-29	-13	-26	-26	-39	-46	40	28	12	25	25	14	8	18	16	12	15	
40,000	-69	-46	-39	-46	-49	-68	-79	66	44	37	43	47	28	19	28	25	23	28	
30,000	-61	-41	-31	-41	-42	-62	-73	59	39	29	38	40	22	12	30	28	19	29	
20,000	-40	-27	-21	-27	-28	-42	-50	39	26	20	26	26	14	7	22	21	13	21	
CHICAGO TO PHILADELPHIA 587 N.MI.																			
53,000	44	29	12	27	27	15	9	-45	-30	-13	-28	-28	-41	-49	17	15	11	14	
40,000	71	47	37	46	50	31	22	-74	-49	-39	-49	-52	-72	-82	27	26	22	27	
30,000	68	44	31	41	44	26	17	-70	-46	-32	-44	-46	-67	-79	27	28	19	27	
20,000	46	30	21	28	30	17	10	-48	-32	-22	-30	-31	-46	-55	21	21	12	21	
CHICAGO TO PHOENIX 1249 N.MI.																			
53,000	-37	-30	-9	-22	-24	-35	-41	36	29	9	21	23	12	7	14	12	9	12	
40,000	-63	-45	-32	-40	-44	-60	-69	59	43	30	37	41	26	19	23	20	17	21	
30,000	-53	-40	-24	-33	-35	-52	-62	49	37	23	30	33	19	12	24	22	14	21	
20,000	-33	-25	-16	-20	-22	-33	-40	31	23	16	18	21	11	7	17	16	9	15	
CHICAGO TO PITTSBURGH 358 N.MI.																			
53,000	43	29	13	27	27	14	8	-44	-30	-13	-27	-27	-41	-48	18	16	12	15	
40,000	70	46	38	46	49	30	20	-73	-48	-39	-48	-51	-71	-83	28	27	23	28	
30,000	66	43	30	41	43	24	15	-68	-45	-32	-44	-45	-67	-79	29	29	20	29	
20,000	45	29	21	28	29	16	9	-47	-31	-22	-29	-30	-46	-55	23	22	13	22	
CHICAGO TO PORTLAND, ORE. 1507 N.MI.																			
53,000	-34	-21	-15	-25	-23	-31	-37	33	21	14	24	22	14	11	12	10	8	10	
40,000	-51	-34	-40	-41	-41	-55	-62	49	33	38	39	40	27	20	19	17	17	20	
30,000	-49	-33	-34	-39	-38	-52	-60	46	31	33	36	36	23	16	22	20	15	21	
20,000	-33	-22	-22	-27	-26	-36	-41	32	21	22	26	25	16	11	15	15	10	15	

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
CHICAGO TO PROVIDENCE																		
53,000	45	29	13	28	27	16	10	-46	-29	-13	-29	-28	-41	-48	16	14	11	14
40,000	71	47	38	49	50	32	23	-73	-49	-40	-51	-52	-71	-81	26	25	22	25
30,000	67	43	33	44	45	27	19	-70	-46	-34	-46	-47	-67	-78	27	27	19	26
20,000	46	30	23	29	31	18	12	-47	-31	-23	-31	-32	-46	-54	21	20	12	20
CHICAGO TO ROCHESTER, MINN.																		
53,000	-38	-24	-14	-24	-24	-36	-43	36	23	13	24	23	12	6	18	16	12	15
40,000	-59	-39	-41	-44	-45	-64	-74	55	37	39	41	42	24	14	28	26	24	30
30,000	-55	-38	-33	-39	-40	-60	-72	51	35	32	36	38	19	9	31	29	21	30
20,000	-38	-25	-21	-27	-27	-42	-49	36	24	21	26	26	12	5	23	22	14	22
CHICAGO TO ROCHESTER, N.Y.																		
53,000	43	27	12	28	27	15	9	-44	-28	-13	-28	-27	-40	-48	17	15	12	15
40,000	68	45	37	47	49	30	21	-71	-47	-39	-50	-51	-70	-81	27	26	23	27
30,000	65	40	32	43	44	25	16	-68	-43	-34	-45	-46	-66	-78	29	29	20	28
20,000	44	27	22	29	29	16	9	-45	-28	-23	-30	-30	-45	-54	22	22	13	22
CHICAGO TO ST. LOUIS																		
53,000	-25	-17	-2	-14	-14	-26	-33	20	15	2	13	11	0	-5	19	17	12	15
40,000	-42	-28	-14	-27	-27	-47	-58	31	22	10	21	20	2	-8	29	27	24	30
30,000	-39	-24	-11	-24	-23	-43	-55	29	19	9	18	18	-1	-10	31	30	20	30
20,000	-24	-15	-10	-12	-15	-29	-37	20	12	9	9	12	-1	-8	23	23	13	22
CHICAGO TO SALT LAKE CITY																		
53,000	-37	-26	-14	-25	-24	-35	-41	36	26	13	24	24	14	10	14	12	9	12
40,000	-60	-40	-42	-43	-46	-62	-70	58	39	41	41	44	29	22	23	20	19	23
30,000	-53	-37	-34	-38	-39	-55	-64	50	35	32	36	37	23	15	25	23	16	23
20,000	-35	-24	-21	-25	-26	-37	-43	33	23	20	24	25	14	9	18	17	11	16
CHICAGO TO SAN FRANCISCO																		
53,000	-35	-26	-14	-23	-23	-33	-38	34	25	13	22	23	14	10	13	11	8	10
40,000	-56	-39	-40	-41	-43	-57	-64	53	37	39	39	41	29	22	20	18	16	20
30,000	-49	-36	-31	-35	-37	-50	-58	46	34	30	32	35	22	15	22	20	14	20
20,000	-32	-23	-19	-22	-23	-33	-39	30	22	19	21	22	13	9	16	15	9	14
CHICAGO TO SEATTLE																		
53,000	-33	-21	-14	-25	-22	-31	-36	32	20	14	24	22	14	10	12	10	8	10
40,000	-49	-33	-38	-41	-40	-53	-60	47	31	37	38	38	25	19	19	17	17	20
30,000	-48	-32	-34	-39	-38	-52	-60	45	30	32	37	36	22	15	22	20	16	21
20,000	-33	-22	-22	-27	-26	-35	-41	32	21	21	26	25	15	10	15	15	10	15
CHICAGO TO SPOKANE																		
53,000	-34	-21	-14	-25	-23	-32	-37	33	20	14	24	22	14	10	13	11	9	10
40,000	-50	-33	-40	-41	-41	-55	-62	48	31	38	39	39	25	19	20	18	18	21
30,000	-49	-32	-34	-39	-38	-53	-61	46	30	33	37	36	22	15	23	21	16	22
20,000	-34	-22	-22	-28	-26	-36	-42	33	21	21	27	25	15	10	16	15	11	15
CHICAGO TO TAMPA																		
53,000	10	10	5	6	8	-1	-6	-16	-13	-5	-8	-10	-20	-25	15	14	10	14
40,000	12	12	11	9	11	-4	-12	-25	-21	-13	-15	-18	-33	-41	23	23	18	23
30,000	11	13	7	7	9	-4	-11	-21	-19	-9	-12	-14	-29	-37	22	23	14	23
20,000	7	8	4	5	6	-4	-9	-12	-11	-4	-7	-8	-18	-24	17	17	10	16
CHICAGO TO TORONTO																		
53,000	41	26	12	27	25	13	8	-42	-27	-12	-27	-26	-39	-46	17	16	12	15
40,000	65	43	36	45	47	28	18	-68	-45	-38	-48	-49	-68	-79	28	26	23	28
30,000	62	38	31	41	42	23	13	-65	-41	-32	-44	-44	-65	-76	30	29	21	29
20,000	42	25	22	28	28	14	7	-43	-27	-22	-29	-29	-44	-53	23	22	14	22
CHICAGO TO TUCSON																		
53,000	-37	-30	-8	-21	-23	-35	-41	35	29	8	20	22	11	6	14	12	9	12
40,000	-63	-46	-28	-39	-43	-59	-69	59	43	27	36	40	25	17	23	20	17	21
30,000	-53	-40	-21	-32	-34	-51	-61	49	37	20	29	32	18	11	24	21	14	20
20,000	-33	-25	-14	-19	-21	-33	-39	31	23	14	17	20	10	6	17	16	9	15
CHICAGO TO TULSA																		
53,000	-34	-25	-6	-19	-20	-33	-40	31	23	5	18	18	7	1	17	16	11	14
40,000	-59	-39	-21	-36	-38	-58	-69	52	35	19	31	33	15	5	27	25	22	27
30,000	-52	-35	-16	-30	-31	-52	-63	46	30	14	26	27	10	1	29	27	18	28
20,000	-33	-22	-13	-18	-20	-34	-42	29	20	12	16	18	6	0	21	20	12	20

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*								STANDARD DEVIATION									
	D I R E C T								R E T U R N									
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
CHICAGO TO WASHINGTON, D.C. 530 N.MI.																		
53,000	42	29	12	25	26	14	8	-44	-30	-12	-26	-27	-40	-48	17	16	12	15
40,000	69	46	36	43	47	29	19	-73	-48	-37	-46	-50	-70	-81	27	26	22	27
30,000	65	42	28	38	42	23	14	-68	-45	-29	-42	-44	-65	-77	27	28	18	28
20,000	44	30	20	26	28	15	9	-46	-31	-20	-28	-30	-45	-54	22	21	12	21
CHICAGO TO WATERLOO 203 N.MI.																		
53,000	-42	-28	-14	-27	-26	-39	-47	41	27	14	26	26	14	8	19	16	12	15
40,000	-67	-45	-41	-47	-50	-70	-80	65	44	40	45	48	29	19	29	26	24	30
30,000	-63	-42	-34	-42	-44	-65	-76	60	40	33	40	42	23	13	32	30	21	30
20,000	-42	-28	-22	-29	-29	-44	-53	41	26	22	28	28	15	7	23	23	14	22
CHICAGO TO WEST PALM BEACH 995 N.MI.																		
53,000	15	14	5	8	10	1	-3	-21	-17	-5*	-10	-12	-22	-28	14	14	9	14
40,000	20	18	13	12	15	1	-6	-32	-25	-14	-18	-22	-37	-45	22	22	17	22
30,000	18	17	8	10	13	0	-6	-27	-23	-9	-15	-18	-32	-40	20	21	14	21
20,000	11	11	4	6	7	-2	-7	-16	-14	-4	-8	-10	-20	-26	16	16	9	15
CINCINNATI TO DALLAS 698 N.MI.																		
53,000	-44	-32	-3	-22	-25	-40	-47	41	30	2	21	23	9	2	16	15	10	14
40,000	-71	-50	-16	-43	-44	-66	-78	67	46	15	40	41	20	10	26	25	20	24
30,000	-62	-42	-12	-34	-36	-59	-70	58	39	10	31	33	13	5	26	25	16	26
20,000	-46	-28	-10	-20	-22	-38	-46	38	26	10	19	21	9	3	19	18	10	18
CINCINNATI TO DETROIT 200 N.MI.																		
53,000	15	8	-1	10	7	-4	-10	-20	-11	0	-12	-10	-22	-29	19	17	13	16
40,000	16	11	2	15	11	-8	-18	-29	-18	-7	-22	-19	-39	-49	30	28	24	29
30,000	15	9	5	14	10	-8	-18	-27	-16	-8	-20	-17	-36	-47	30	30	20	30
20,000	11	4	5	8	7	-7	-14	-17	-8	-6	-11	-10	-24	-32	23	23	14	23
CINCINNATI TO FORT LAUDERDALE 811 N.MI.																		
53,000	10	11	4	5	7	-2	-6	-16	-14	-4	-7	-10	-20	-25	15	15	9	15
40,000	11	12	9	7	10	-5	-12	-24	-20	-11	-12	-16	-32	-40	23	24	17	22
30,000	10	13	6	6	8	-4	-11	-20	-19	-7	-10	-13	-27	-34	20	22	14	21
20,000	6	8	1	2	4	-5	-10	-10	-11	-2	-4	-6	-16	-22	17	16	9	15
CINCINNATI TO LOS ANGELES 1646 N.MI.																		
53,000	-40	-31	-9	-23	-25	-37	-43	39	31	8	23	25	14	9	13	11	8	11
40,000	-65	-48	-32	-43	-46	-61	-70	63	46	31	40	44	30	23	20	19	15	19
30,000	-55	-42	-24	-35	-37	-53	-62	53	40	23	33	35	22	16	22	20	13	19
20,000	-35	-27	-15	-21	-23	-34	-41	34	26	15	20	22	13	9	15	14	8	13
CINCINNATI TO MIAMI 825 N.MI.																		
53,000	9	11	4	5	7	-2	-7	-15	-14	-4	-7	-9	-19	-25	14	15	9	15
40,000	10	11	9	6	9	-5	-13	-23	-20	-11	-12	-16	-31	-39	22	23	17	22
30,000	10	13	6	5	8	-4	-11	-19	-19	-6	-9	-13	-26	-34	20	21	14	21
20,000	5	7	1	2	4	-5	-10	-10	-10	-2	-4	-5	-16	-21	17	16	9	15
CINCINNATI TO NEW YORK 510 N.MI.																		
53,000	49	31	10	29	29	15	8	-50	-32	-10	-30	-29	-44	-52	17	16	12	15
40,000	75	50	33	51	51	31	21	-78	-52	-35	-53	-53	-74	-86	28	27	23	27
30,000	71	46	29	45	45	26	17	-73	-48	-30	-47	-47	-69	-82	27	28	18	28
20,000	49	31	20	30	30	17	11	-51	-32	-21	-31	-32	-48	-58	22	22	12	21
CINCINNATI TO PITTSBURGH 222 N.MI.																		
53,000	47	29	8	28	27	12	6	-48	-30	-9	-28	-28	-43	-52	19	17	13	16
40,000	70	46	29	48	47	26	16	-74	-49	-31	-50	-50	-72	-84	29	28	24	29
30,000	65	42	25	43	42	22	12	-69	-45	-26	-45	-44	-67	-80	28	30	19	30
20,000	45	27	18	28	28	14	7	-47	-29	-19	-29	-29	-46	-56	23	23	13	23
CINCINNATI TO ST. LOUIS 267 N.MI.																		
53,000	-49	-34	-9	-28	-29	-44	-52	48	33	9	27	28	14	7	19	17	12	16
40,000	-77	-53	-31	-50	-52	-74	-86	75	51	30	48	50	29	19	29	28	23	29
30,000	-70	-47	-24	-44	-44	-67	-80	68	45	23	41	42	22	13	30	29	19	30
20,000	-47	-31	-18	-28	-29	-46	-55	46	30	18	27	28	14	8	23	22	13	22
CINCINNATI TO ST. PETERSBURG 675 N.MI.																		
53,000	2	5	4	2	4	-6	-11	-9	-9	-5	-4	-6	-16	-21	15	15	10	15
40,000	0	4	8	0	3	-12	-21	-14	-13	-10	-7	-11	-26	-34	24	25	19	23
30,000	1	6	4	0	3	-11	-19	-11	-12	-5	-5	-8	-22	-30	22	23	15	23
20,000	-1	4	2	0	1	-9	-15	-4	-7	-2	-2	-3	-14	-19	18	18	10	16

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
CINCINNATI TO TAMPA																		
53,000	3	6	4	3	4	-5	-10	-10	-9	-5	-4	-7	-16	-22	15	16	10	15
40,000	1	5	8	1	4	-11	-20	-15	-14	-10	-7	-11	-27	-35	24	25	19	23
30,000	2	6	5	1	3	-10	-18	-12	-13	-6	-6	-9	-23	-31	22	23	15	23
20,000	0	4	2	0	1	-9	-14	-5	-7	-2	-2	-4	-14	-20	18	18	10	17
CINCINNATI TO WASHINGTON, D.C.																		
53,000	49	33	9	28	29	14	8	-50	-33	-10	-29	-29	-45	-53	18	17	12	16
40,000	77	52	32	49	51	31	21	-79	-54	-33	-52	-53	-75	-87	28	28	23	28
30,000	72	47	26	43	45	25	16	-74	-49	-27	-46	-47	-69	-82	27	29	18	29
20,000	49	32	19	28	30	16	9	-50	-33	-19	-29	-31	-48	-58	22	22	13	21
CLEVELAND TO HARTFORD																		
53,000	46	29	12	29	28	15	9	-47	-30	-13	-30	-29	-43	-51	18	16	12	15
40,000	73	48	37	50	51	32	22	-75	-50	-39	-53	-53	-74	-85	28	27	24	28
30,000	70	45	33	45	46	27	17	-72	-47	-34	-47	-48	-70	-82	30	30	20	29
20,000	48	31	23	30	31	17	11	-49	-32	-23	-32	-32	-48	-58	23	22	13	22
CLEVELAND TO INDIANAPOLIS																		
53,000	-45	-28	-9	-27	-26	-41	-49	43	27	8	26	25	12	5	19	17	13	16
40,000	-70	-46	-31	-48	-48	-69	-81	65	43	29	45	45	24	14	29	28	24	29
30,000	-65	-42	-26	-43	-42	-65	-77	61	39	25	40	39	20	10	30	30	20	30
20,000	-44	-27	-19	-28	-28	-44	-53	42	25	18	26	26	12	5	23	23	14	23
CLEVELAND TO KNOXVILLE																		
53,000	-21	-11	2	-12	-10	-22	-29	16	8	-2	9	7	-4	-10	18	17	12	16
40,000	-31	-19	-4	-24	-19	-38	-49	16	11	1	17	11	-7	-17	28	28	23	28
30,000	-28	-17	-6	-21	-17	-36	-46	15	10	4	15	10	-6	-15	27	29	18	29
20,000	-19	-8	-5	-12	-10	-24	-32	13	5	4	9	7	-5	-12	22	22	12	21
CLEVELAND TO LOS ANGELES																		
53,000	-38	-29	-11	-23	-25	-35	-41	37	29	10	23	24	14	10	12	11	8	10
40,000	-63	-45	-36	-42	-45	-60	-67	60	43	34	39	43	30	24	20	18	15	19
30,000	-54	-40	-27	-35	-37	-52	-61	51	38	26	33	35	23	17	21	19	13	18
20,000	-35	-26	-18	-22	-24	-34	-40	33	24	17	21	23	14	10	15	14	8	13
CLEVELAND TO MIAMI																		
53,000	-1	4	4	0	2	-7	-12	-5	-7	-4	-2	-5	-13	-18	14	14	9	14
40,000	-1	0	7	-4	1	-14	-22	-12	-9	-9	-3	-8	-22	-30	22	23	17	22
30,000	-1	4	3	-3	1	-11	-19	-10	-10	-5	-2	-6	-19	-26	19	21	14	21
20,000	-1	3	-1	-3	0	-10	-15	-4	-6	0	1	-2	-11	-17	16	16	9	15
CLEVELAND TO MILWAUKEE																		
53,000	-42	-28	-14	-27	-26	-39	-47	41	27	13	26	25	14	8	18	16	12	15
40,000	-68	-45	-40	-47	-50	-69	-80	65	43	39	44	47	28	18	28	27	24	29
30,000	-65	-43	-33	-43	-44	-65	-77	61	40	32	40	42	23	13	30	30	21	30
20,000	-44	-29	-22	-29	-30	-45	-54	42	28	22	28	29	15	8	23	23	14	22
CLEVELAND TO NEW YORK																		
53,000	46	30	12	28	28	15	9	-47	-31	-13	-29	-29	-43	-51	18	16	12	15
40,000	74	49	37	49	51	31	21	-76	-51	-39	-51	-53	-74	-86	29	28	24	28
30,000	70	45	32	43	46	26	17	-73	-48	-33	-46	-48	-70	-82	29	30	20	29
20,000	48	32	22	29	31	17	10	-50	-33	-23	-31	-32	-48	-58	23	23	13	22
CLEVELAND TO PHILADELPHIA																		
53,000	43	29	12	26	27	14	8	-45	-30	-13	-27	-28	-42	-50	18	17	12	16
40,000	72	47	36	45	49	29	19	-75	-50	-38	-48	-52	-73	-84	29	28	24	28
30,000	68	44	30	40	44	24	15	-71	-47	-31	-43	-46	-68	-81	29	30	20	30
20,000	47	31	21	27	30	16	9	-49	-33	-21	-29	-31	-47	-57	23	23	13	22
CLEVELAND TO ROCHESTER, N.Y.																		
53,000	41	25	9	26	24	11	5	-42	-26	-10	-27	-25	-39	-47	18	17	13	16
40,000	62	40	30	45	43	23	13	-66	-44	-33	-48	-47	-68	-79	29	28	25	29
30,000	59	35	27	41	39	20	10	-64	-39	-29	-44	-42	-64	-76	30	31	21	30
20,000	41	23	19	27	26	12	5	-43	-25	-20	-29	-28	-44	-53	24	24	14	23
CLEVELAND TO ST. LOUIS																		
53,000	-45	-30	-9	-27	-27	-41	-49	44	29	8	26	26	12	6	18	16	12	15
40,000	-71	-48	-31	-48	-49	-69	-80	68	45	29	45	46	26	16	28	26	23	28
30,000	-66	-43	-25	-43	-42	-64	-76	63	41	24	40	40	21	12	29	28	19	29
20,000	-45	-28	-19	-27	-28	-44	-53	43	26	18	26	27	13	7	22	22	13	21

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	DIRECT							RETURN							JAN	APR	JUL	OCT				
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85								
CLEVELAND TO ST. PETERSBURG																			811 N.MI.			
53,000	-9	-2	4	-3	-2	-12	-17	2	-2	-4	1	-1	-10	-15	15	15	10	14				
40,000	-13	-7	5	-10	-6	-22	-31	-1	-2	-7	4	-2	-17	-25	23	24	18	23				
30,000	-11	-4	1	-9	-5	-19	-27	0	-3	-3	3	-1	-14	-22	21	23	15	23				
20,000	-8	-2	-1	-5	-4	-14	-20	3	-1	0	3	1	-9	-14	18	17	10	16				
CLEVELAND TO TAMPA																			808 N.MI.			
53,000	-8	-2	4	-3	-2	-11	-17	2	-2	-5	1	-1	-10	-15	15	15	10	14				
40,000	-12	-7	5	-10	-6	-21	-30	-2	-2	-7	3	-2	-17	-25	23	24	18	23				
30,000	-10	-3	1	-8	-4	-19	-27	-1	-4	-3	3	-1	-15	-22	21	23	15	23				
20,000	-8	-1	-1	-5	-3	-14	-20	2	-2	0	3	1	-9	-15	18	18	10	16				
CLEVELAND TO WASHINGTON, D.C.																			269 N.MI.			
53,000	35	26	11	21	22	10	4	-38	-27	-12	-22	-24	-37	-44	18	17	13	16				
40,000	60	40	32	35	41	22	12	-67	-44	-34	-40	-45	-66	-78	29	29	24	29				
30,000	57	37	24	31	36	17	7	-63	-41	-26	-36	-40	-61	-73	28	30	20	30				
20,000	39	28	17	21	25	11	4	-42	-30	-18	-23	-27	-43	-52	23	23	13	22				
COLORADO SPRINGS TO OKLAHOMA CITY																			397 N.MI.			
53,000	35	25	6	21	21	8	2	-37	-27	-6	-22	-22	-36	-43	18	16	12	15				
40,000	53	38	23	38	37	19	9	-59	-41	-25	-40	-40	-60	-71	30	26	21	26				
30,000	43	33	19	32	30	13	4	-47	-36	-20	-34	-32	-52	-63	30	27	17	27				
20,000	31	23	10	19	19	7	1	-33	-25	-11	-21	-20	-35	-43	22	19	12	19				
COLUMBIA TO JACKSONVILLE																			214 N.MI.			
53,000	-10	-3	4	-4	-2	-14	-21	4	0	-5	2	0	-11	-16	17	18	11	18				
40,000	-17	-12	6	-12	-8	-27	-36	4	2	-7	6	1	-16	-25	26	28	20	26				
30,000	-14	-5	2	-9	-6	-22	-30	4	-1	-3	5	1	-14	-22	23	25	16	25				
20,000	-11	-5	-2	-6	-5	-17	-23	6	2	1	5	3	-7	-13	19	19	10	18				
COLUMBIA TO MERIDIAN																			395 N.MI.			
53,000	-51	-37	1	-23	-28	-46	-54	50	36	-1	23	27	7	-1	17	17	11	16				
40,000	-76	-58	-11	-48	-48	-73	-85	73	56	9	46	47	21	9	26	27	20	25				
30,000	-65	-48	-9	-38	-39	-63	-74	64	45	8	36	37	15	5	24	26	16	26				
20,000	-42	-32	-7	-21	-24	-41	-49	41	31	6	20	23	8	3	19	19	10	18				
COLUMBIA TO MONTGOMERY																			283 N.MI.			
53,000	-50	-35	2	-23	-27	-45	-53	49	34	-2	22	26	6	-2	17	17	11	17				
40,000	-73	-57	-9	-47	-47	-71	-84	70	54	8	44	44	19	7	27	28	21	26				
30,000	-63	-46	-8	-37	-38	-61	-72	61	43	7	35	36	14	4	24	26	16	26				
20,000	-42	-31	-7	-21	-23	-40	-49	40	29	6	20	22	8	2	20	20	11	18				
COLUMBIA TO PENSACOLA																			373 N.MI.			
53,000	-45	-31	4	-19	-23	-41	-48	43	29	-4	18	21	3	-4	16	17	11	16				
40,000	-66	-51	-4	-41	-41	-65	-76	61	47	3	38	38	14	2	26	27	20	25				
30,000	-56	-40	-5	-32	-33	-55	-65	53	37	4	30	30	10	1	23	25	16	24				
20,000	-37	-27	-4	-18	-20	-35	-44	35	25	4	17	18	5	0	19	19	10	17				
COLUMBIA TO WASHINGTON, D.C.																			354 N.MI.			
53,000	29	18	-2	15	14	1	-5	-33	-21	1	-17	-16	-31	-39	17	17	11	16				
40,000	38	28	6	33	25	6	-4	-49	-35	-9	-38	-32	-53	-64	27	29	22	27				
30,000	35	25	8	28	22	5	-3	-44	-30	-9	-32	-27	-47	-58	25	28	17	27				
20,000	29	16	8	17	16	4	-3	-33	-19	-8	-19	-18	-33	-42	21	21	12	20				
COLUMBUS, OHIO TO NEW YORK																			418 N.MI.			
53,000	49	31	11	29	29	15	9	-50	-32	-11	-30	-29	-45	-52	18	16	12	15				
40,000	76	50	35	51	52	32	22	-78	-52	-37	-53	-54	-75	-87	28	28	23	28				
30,000	72	46	30	45	46	27	18	-74	-49	-31	-47	-48	-70	-83	28	29	19	29				
20,000	50	31	21	30	31	17	11	-51	-33	-22	-31	-32	-49	-59	23	22	13	22				
COLUMBUS, OHIO TO PHILADELPHIA																			352 N.MI.			
53,000	49	32	11	29	29	15	9	-50	-32	-12	-30	-30	-45	-53	18	17	12	16				
40,000	77	51	36	50	52	32	22	-80	-53	-37	-52	-54	-76	-88	29	28	24	28				
30,000	73	47	30	44	46	27	17	-75	-49	-31	-47	-48	-71	-84	28	29	19	29				
20,000	50	32	21	30	31	17	11	-52	-34	-21	-31	-32	-49	-59	23	23	13	22				
COLUMBUS, OHIO TO TAMPA																			722 N.MI.			
53,000	-4	1	4	-1	1	-9	-15	-2	-5	-5	-1	-3	-12	-17	15	15	10	15				
40,000	-8	-3	6	-6	-2	-18	-27	-6	-6	-8	0	-5	-20	-29	24	25	19	23				
30,000	-6	0	3	-5	-2	-16	-24	-5	-7	-4	0	-4	-17	-25	21	23	15	23				
20,000	-5	0	0	-3	-2	-12	-18	0	-3	-1	1	-1	-11	-16	18	18	10	17				

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HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
COLUMBUS, OHIO TO WASHINGTON, D.C.																		
53,000	46	31	11	27	27	14	8	-47	-32	-11	-27	-28	-43	-51	18	17	12	16
40,000	75	50	34	46	50	29	19	-78	-52	-35	-49	-52	-74	-86	29	29	24	29
30,000	70	45	27	41	44	24	15	-73	-48	-28	-44	-46	-69	-82	28	30	19	30
20,000	48	32	19	27	29	15	9	-50	-33	-20	-28	-31	-48	-58	23	23	13	22
DALLAS TO DENVER																		
53,000	-31	-21	-5	-18	-18	-30	-37	28	19	4	16	16	5	-1	17	15	11	15
40,000	-47	-33	-19	-34	-32	-51	-60	38	28	17	30	27	10	1	28	25	20	25
30,000	-37	-29	-15	-29	-26	-44	-54	30	24	14	26	22	7	-1	29	25	16	25
20,000	-27	-20	-7	-17	-16	-29	-37	24	18	6	16	14	3	-2	20	18	11	17
DALLAS TO EL PASO																		
53,000	-45	-36	0	-20	-25	-42	-49	44	36	0	19	25	8	0	17	15	11	15
40,000	-70	-59	-14	-44	-46	-69	-81	68	57	13	42	44	22	12	28	26	19	23
30,000	-58	-49	-9	-33	-35	-58	-69	56	47	8	31	33	13	5	28	24	15	23
20,000	-36	-30	-5	-17	-20	-36	-44	35	29	4	16	19	6	0	19	17	10	16
DALLAS TO HOUSTON																		
53,000	10	9	3	7	7	-4	-9	-15	-13	-3	-8	-9	-20	-26	18	17	11	16
40,000	10	13	7	15	11	-6	-15	-23	-22	-8	-20	-18	-35	-45	29	27	21	23
30,000	9	11	6	12	9	-6	-14	-18	-17	-7	-16	-13	-30	-39	27	26	16	25
20,000	7	8	-4	6	3	-8	-13	-11	-11	4	-8	-5	-18	-25	20	18	10	17
DALLAS TO JACKSON																		
53,000	48	37	0	22	27	8	1	-49	-37	-1	-22	-27	-45	-53	17	16	11	16
40,000	71	57	11	46	46	22	10	-74	-59	-12	-47	-48	-72	-84	28	27	20	24
30,000	59	47	8	34	35	14	5	-62	-48	-8	-36	-37	-61	-72	27	26	16	26
20,000	38	30	2	19	21	5	-1	-39	-31	-2	-20	-21	-39	-47	20	19	10	18
DALLAS TO KANSAS CITY																		
53,000	11	11	-1	5	6	-4	-10	-16	-14	0	-7	-8	-20	-27	18	16	12	15
40,000	24	15	2	9	11	-6	-15	-36	-23	-4	-15	-18	-38	-48	29	27	21	26
30,000	20	13	0	4	8	-8	-17	-30	-19	-1	-9	-13	-32	-44	29	27	16	27
20,000	10	7	3	3	5	-6	-12	-15	-10	-4	-5	-8	-20	-27	21	20	11	19
DALLAS TO LAS VEGAS																		
53,000	-40	-32	-5	-21	-24	-37	-44	39	31	4	21	23	10	4	15	13	10	13
40,000	-62	-51	-23	-41	-43	-61	-72	59	48	22	39	41	24	15	25	23	18	22
30,000	-52	-43	-17	-33	-34	-53	-63	49	41	16	31	32	16	9	27	23	14	21
20,000	-33	-27	-9	-17	-20	-33	-40	32	26	8	16	19	8	3	18	16	10	15
DALLAS TO LITTLE ROCK																		
53,000	44	34	0	20	24	7	0	-46	-35	-1	-21	-25	-43	-50	18	17	12	16
40,000	71	52	10	41	43	19	8	-74	-55	-12	-44	-45	-70	-83	29	28	21	25
30,000	60	43	6	30	32	11	2	-62	-46	-7	-33	-35	-60	-72	29	27	16	28
20,000	38	28	5	17	20	6	0	-39	-29	-6	-18	-21	-38	-47	21	19	11	19
DALLAS TO LOS ANGELES																		
53,000	-40	-33	-4	-21	-24	-38	-44	39	32	3	20	24	10	3	15	13	10	12
40,000	-62	-52	-22	-40	-43	-61	-71	59	50	21	39	41	24	16	24	22	17	20
30,000	-52	-44	-15	-32	-34	-52	-62	49	42	15	30	32	17	9	25	21	14	19
20,000	-33	-27	-8	-16	-19	-32	-39	31	26	7	15	18	8	3	17	15	9	14
DALLAS TO LOUISVILLE																		
53,000	42	31	2	21	24	8	2	-44	-33	-2	-22	-25	-41	-48	17	15	11	14
40,000	69	47	14	41	42	20	10	-73	-51	-16	-44	-45	-68	-80	26	26	20	24
30,000	59	40	10	31	33	13	4	-63	-43	-11	-34	-36	-59	-71	26	25	16	26
20,000	39	27	9	19	21	8	3	-41	-28	-9	-20	-22	-38	-47	20	19	11	18
DALLAS TO LUBBOCK																		
53,000	-45	-35	-3	-21	-25	-42	-50	44	34	2	20	24	8	2	18	16	12	16
40,000	-69	-55	-16	-45	-45	-69	-81	65	53	15	43	43	21	10	30	28	21	25
30,000	-57	-46	-11	-35	-35	-58	-70	54	44	10	33	33	13	4	29	26	16	26
20,000	-37	-30	-5	-19	-21	-37	-46	36	29	4	18	20	6	0	21	19	11	18
DALLAS TO MEMPHIS																		
53,000	46	35	1	22	25	9	1	-48	-36	-1	-23	-26	-44	-52	18	16	11	16
40,000	74	53	12	43	45	21	10	-76	-56	-13	-46	-47	-72	-84	28	28	21	25
30,000	62	44	7	32	34	12	3	-65	-47	-8	-35	-37	-61	-74	28	26	16	27
20,000	40	29	6	19	21	7	1	-41	-30	-6	-20	-22	-39	-48	21	19	11	18

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANOARO DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANOARD DEVIATION			
	D I R E C T								R E T U R N											
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT		
DALLAS TO MIAMI																			963 N.MI.	
53,000	39	32	-3	16	22	5	-2	-41	-33	2	-17	-23	-38	-45	14	14	9	14		
40,000	54	51	5	35	37	16	7	-59	-54	-6	-37	-40	-60	-69	21	21	16	19		
30,000	44	40	4	27	29	11	4	-48	-43	-5	-28	-31	-49	-57	19	19	12	18		
20,000	27	25	0	13	15	3	-2	-29	-26	0	-14	-16	-29	-36	15	14	8	13		
DALLAS TO MIDLAND																			276 N.MI.	
53,000	-46	-37	0	-20	-25	-43	-51	45	36	0	19	24	7	-1	18	16	12	16		
40,000	-72	-59	-12	-44	-46	-71	-83	70	58	11	43	45	21	10	29	27	21	24		
30,000	-60	-49	-6	-33	-35	-59	-71	58	47	5	31	33	11	3	28	26	15	25		
20,000	-37	-30	-4	-17	-20	-37	-45	36	29	4	16	20	6	0	20	18	11	18		
DALLAS TO MONROE																			244 N.MI.	
53,000	48	36	1	21	26	8	1	-49	-37	-1	-22	-27	-45	-53	18	17	12	16		
40,000	70	57	11	45	46	22	10	-73	-59	-12	-47	-48	-72	-84	29	28	21	24		
30,000	59	47	8	34	35	13	4	-61	-48	-8	-36	-37	-61	-73	28	26	16	26		
20,000	38	30	2	19	20	5	-1	-39	-31	-2	-19	-21	-38	-47	20	19	11	18		
DALLAS TO NEW ORLEANS																			379 N.MI.	
53,000	39	32	-1	18	21	6	-1	-42	-33	0	-19	-23	-39	-47	17	16	11	15		
40,000	56	50	9	39	38	17	6	-62	-54	-10	-42	-42	-64	-75	27	26	20	23		
30,000	47	40	6	30	29	10	2	-51	-43	-7	-32	-32	-53	-64	25	25	15	24		
20,000	30	26	-2	16	16	2	-4	-32	-27	1	-17	-17	-33	-41	19	18	10	17		
DALLAS TO NEW YORK																			1199 N.MI.	
53,000	46	32	4	25	27	12	5	-48	-33	-5	-26	-28	-42	-49	14	13	9	12		
40,000	72	49	21	46	46	27	18	-75	-52	-22	-48	-49	-69	-80	22	22	18	21		
30,000	64	43	17	38	39	21	13	-67	-46	-18	-40	-41	-62	-72	22	22	14	22		
20,000	43	29	13	24	25	14	9	-45	-30	-14	-25	-26	-41	-49	17	17	9	16		
DALLAS TO ORLANDO																			840 N.MI.	
53,000	44	35	-2	19	25	6	-2	-46	-36	2	-20	-26	-42	-49	14	14	9	14		
40,000	62	55	7	41	42	20	9	-66	-58	-8	-43	-45	-66	-76	23	23	17	20		
30,000	52	44	6	31	33	13	5	-55	-46	-6	-33	-35	-55	-64	21	21	13	20		
20,000	33	28	2	16	18	5	0	-34	-29	-2	-17	-19	-34	-41	16	15	9	14		
DALLAS TO ST. LOUIS																			474 N.MI.	
53,000	31	24	1	16	17	4	-2	-34	-26	-1	-17	-19	-33	-41	18	16	11	15		
40,000	53	36	10	29	31	11	1	-61	-41	-12	-34	-36	-58	-69	28	27	21	25		
30,000	46	31	6	22	24	6	-3	-52	-35	-7	-26	-28	-50	-62	28	26	16	27		
20,000	29	20	7	13	15	4	-2	-32	-22	-8	-14	-17	-31	-40	21	19	11	19		
DALLAS TO SAN ANTONIO																			216 N.MI.	
53,000	-26	-20	5	-8	-11	-26	-33	21	17	-6	6	9	-4	-10	18	16	12	16		
40,000	-44	-34	1	-20	-23	-44	-56	34	27	-2	15	17	-2	-11	29	27	21	23		
30,000	-36	-28	4	-14	-16	-37	-49	28	22	-4	10	12	-5	-13	27	25	15	25		
20,000	-21	-15	-4	-7	-10	-23	-30	17	13	4	5	9	-2	-8	20	18	10	17		
DALLAS TO SAN FRANCISCO																			1279 N.MI.	
53,000	-38	-29	-6	-21	-23	-35	-41	37	28	6	20	22	11	5	14	12	9	12		
40,000	-58	-46	-25	-39	-41	-57	-67	55	44	24	37	39	24	16	23	21	17	20		
30,000	-49	-40	-19	-32	-33	-50	-59	46	38	17	30	31	17	10	24	21	14	19		
20,000	-31	-25	-10	-17	-19	-31	-38	30	24	10	16	18	9	4	17	15	9	14		
DALLAS TO SEATTLE																			1449 N.MI.	
53,000	-31	-20	-7	-20	-19	-29	-34	29	19	7	19	18	9	5	13	11	8	11		
40,000	-46	-32	-23	-35	-33	-48	-56	41	28	20	32	30	16	9	21	19	16	20		
30,000	-41	-29	-20	-32	-29	-44	-52	36	26	18	29	26	13	6	23	21	14	20		
20,000	-28	-19	-11	-20	-18	-29	-35	26	18	10	18	17	8	3	16	15	9	14		
DALLAS TO TUCSON																			714 N.MI.	
53,000	-43	-36	-1	-20	-25	-40	-47	42	35	1	20	24	8	1	16	14	11	14		
40,000	-67	-57	-17	-42	-45	-66	-77	64	55	16	41	43	23	13	26	24	18	22		
30,000	-56	-47	-11	-32	-35	-56	-67	54	46	10	31	33	15	7	27	23	14	21		
20,000	-35	-29	-5	-16	-19	-34	-42	34	28	5	15	19	6	1	18	16	9	15		
DALLAS TO TULSA																			207 N.MI.	
53,000	9	11	-2	4	5	-6	-12	-15	-14	2	-6	-8	-20	-27	19	17	12	16		
40,000	23	15	0	8	10	-8	-18	-35	-23	-1	-14	-17	-37	-49	30	29	22	26		
30,000	20	13	-2	3	7	-10	-19	-29	-19	1	-7	-11	-31	-43	30	27	17	28		
20,000	10	6	3	2	5	-7	-13	-14	-9	-4	-4	-7	-19	-26	22	20	11	19		

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
DALLAS TO WASHINGTON, D.C.																	1026 N.MI.	
53,000	47	33	3	24	27	11	4	-49	-34	-4	-25	-28	-43	-50	15	14	9	13
40,000	73	51	18	46	47	26	16	-76	-54	-20	-48	-49	-70	-81	23	23	18	22
30,000	65	44	14	37	38	19	11	-68	-47	-15	-40	-41	-63	-73	22	23	14	23
20,000	43	29	11	23	25	12	7	-45	-31	-11	-24	-26	-41	-49	18	17	10	16
DAYTON TO HARTFORD																	536 N.MI.	
53,000	47	29	11	29	28	15	9	-48	-30	-11	-30	-29	-43	-51	17	16	12	15
40,000	73	48	35	50	50	31	21	-76	-50	-36	-53	-53	-73	-84	27	26	23	27
30,000	69	44	30	45	45	26	17	-72	-47	-32	-47	-47	-69	-81	28	28	19	28
20,000	48	30	21	30	30	17	11	-49	-31	-22	-31	-32	-47	-57	22	22	13	21
DAYTON TO LOS ANGELES																	1668 N.MI.	
53,000	-39	-31	-10	-23	-25	-36	-42	38	30	9	23	25	14	9	13	11	8	10
40,000	-64	-47	-34	-42	-46	-61	-69	62	45	32	40	44	30	23	20	18	16	19
30,000	-55	-41	-25	-35	-37	-52	-62	52	39	24	33	35	22	16	22	20	13	19
20,000	-35	-26	-16	-21	-23	-34	-40	34	25	16	20	22	13	9	15	14	9	13
DAYTON TO NEW YORK																	479 N.MI.	
53,000	49	31	11	29	29	15	9	-49	-32	-11	-30	-29	-44	-52	18	16	12	15
40,000	76	50	35	51	52	32	22	-78	-52	-37	-53	-54	-75	-86	28	27	23	27
30,000	72	46	30	45	46	27	18	-74	-48	-31	-47	-48	-70	-83	28	29	19	28
20,000	49	31	21	30	31	17	11	-51	-33	-22	-31	-32	-48	-58	22	22	13	21
DAYTON TO ST. LOUIS																	294 N.MI.	
53,000	-47	-32	-9	-27	-28	-43	-51	46	31	9	27	27	13	7	18	17	12	15
40,000	-75	-51	-31	-49	-51	-72	-84	72	49	29	47	48	28	17	29	27	23	29
30,000	-69	-46	-24	-43	-43	-66	-79	66	44	23	41	41	21	12	30	29	19	30
20,000	-46	-30	-19	-28	-29	-45	-55	45	29	18	27	28	14	7	22	22	13	22
DAYTON TO WASHINGTON, D.C.																	339 N.MI.	
53,000	47	32	11	27	28	14	8	-48	-32	-11	-28	-29	-44	-52	18	17	12	16
40,000	76	50	34	47	51	30	20	-78	-53	-35	-50	-53	-75	-86	29	28	23	28
30,000	71	46	27	42	44	25	15	-73	-48	-28	-44	-46	-69	-82	27	29	19	29
20,000	48	32	19	28	30	16	9	-50	-33	-20	-29	-31	-48	-58	23	22	13	22
DAYTONA BEACH TO MIAMI																	207 N.MI.	
53,000	6	11	1	4	5	-5	-11	-10	-13	-2	-5	-7	-18	-24	17	17	10	18
40,000	7	7	6	4	6	-9	-18	-16	-16	-7	-8	-11	-27	-36	24	25	18	24
30,000	6	13	4	4	6	-6	-13	-11	-17	-5	-6	-9	-22	-30	19	21	14	20
20,000	6	6	-4	-1	1	-8	-13	-8	-8	3	0	-2	-12	-18	17	16	9	14
DENVER TO EL PASO																	484 N.MI.	
53,000	-8	-10	-5	-3	-6	-16	-22	4	7	5	1	4	-5	-11	17	15	11	15
40,000	-17	-14	-11	-8	-12	-29	-38	6	7	8	2	6	-11	-20	29	26	21	25
30,000	-14	-12	-7	-4	-9	-25	-34	6	6	5	0	4	-11	-20	30	26	16	24
20,000	-5	-6	-7	-2	-5	-16	-22	2	3	7	0	4	-8	-14	21	18	11	17
DENVER TO KANSAS CITY																	478 N.MI.	
53,000	39	29	11	25	25	13	7	-40	-30	-11	-25	-25	-39	-46	18	16	11	15
40,000	68	43	37	43	46	28	19	-71	-45	-38	-45	-48	-68	-79	28	25	22	27
30,000	53	38	28	36	37	20	11	-55	-40	-29	-38	-39	-58	-69	30	27	18	27
20,000	35	25	17	24	24	12	6	-36	-26	-17	-25	-25	-39	-47	22	20	12	19
DENVER TO LAS VEGAS																	534 N.MI.	
53,000	-31	-26	-11	-20	-21	-32	-39	29	25	11	19	20	10	5	17	14	11	14
40,000	-49	-39	-37	-37	-40	-57	-67	45	36	36	34	37	21	12	28	25	21	26
30,000	-42	-35	-28	-29	-32	-50	-60	38	32	27	26	30	14	5	31	27	18	25
20,000	-26	-21	-17	-16	-19	-31	-38	24	20	16	15	18	7	1	21	19	12	18
DENVER TO LINCOLN																	377 N.MI.	
53,000	36	27	12	23	24	12	7	-37	-28	-13	-24	-24	-37	-44	18	16	12	15
40,000	65	40	39	40	45	27	17	-67	-42	-41	-42	-47	-66	-77	29	26	23	27
30,000	50	36	30	34	36	19	10	-52	-38	-31	-36	-38	-57	-68	31	28	18	28
20,000	32	23	18	23	23	11	5	-33	-25	-19	-24	-24	-38	-45	22	21	12	19
DENVER TO LOS ANGELES																	736 N.MI.	
53,000	-30	-26	-10	-19	-20	-31	-37	28	25	10	18	19	9	4	16	14	10	13
40,000	-47	-38	-35	-34	-38	-54	-63	43	35	34	32	36	20	12	26	24	20	24
30,000	-40	-34	-25	-27	-31	-47	-56	36	31	24	25	28	13	5	29	25	17	23
20,000	-25	-21	-16	-15	-18	-30	-36	23	20	15	14	17	7	1	20	18	11	16

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*												STANDARD DEVIATION					
	D I R E C T							R E T U R N										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
DENVER TO LUBBOCK																		
53,000	14	7	0	9	7	-3	-9	-18	-10	-1	-11	-9	-20	-27	18	16	395 N.MI. 12	15
40,000	15	11	6	15	11	-6	-15	-27	-18	-9	-20	-18	-36	-46	30	26	21	26
30,000	13	10	6	15	10	-6	-15	-21	-15	-8	-19	-15	-32	-42	31	27	17	26
20,000	13	9	2	9	7	-4	-10	-16	-11	-3	-11	-9	-22	-29	22	19	11	18
DENVER TO MILWAUKEE																		
53,000	36	26	13	23	24	13	8	-37	-27	-13	-24	-24	-36	-42	16	14	787 N.MI. 10	13
40,000	62	40	39	40	44	28	19	-64	-42	-40	-43	-47	-64	-74	25	22	20	25
30,000	52	36	31	35	37	21	13	-55	-38	-32	-37	-39	-57	-66	27	25	17	25
20,000	34	24	20	24	24	13	7	-35	-25	-20	-25	-25	-38	-45	20	19	11	18
DENVER TO MINNEAPOLIS																		
53,000	28	21	13	18	19	10	5	-30	-22	-13	-20	-20	-31	-37	16	14	601 N.MI. 11	13
40,000	47	32	36	32	37	20	11	-52	-35	-39	-35	-40	-57	-66	26	23	21	26
30,000	40	29	29	27	31	14	5	-44	-32	-31	-31	-34	-51	-61	29	26	18	27
20,000	25	19	18	19	20	8	2	-27	-20	-19	-21	-21	-34	-40	21	19	12	19
DENVER TO NEW YORK																		
53,000	42	29	12	26	26	16	11	-43	-30	-13	-27	-27	-39	-45	13	12	1419 N.MI. 9	11
40,000	70	45	38	45	48	33	26	-72	-47	-39	-47	-50	-67	-75	21	20	17	21
30,000	61	41	30	40	41	27	20	-64	-43	-31	-42	-43	-60	-70	22	21	14	21
20,000	41	28	20	27	27	17	13	-43	-29	-21	-28	-29	-40	-48	17	16	10	16
DENVER TO OMAHA																		
53,000	36	27	12	23	24	12	7	-37	-28	-13	-24	-24	-37	-44	18	16	377 N.MI. 12	15
40,000	65	40	39	40	45	27	17	-67	-42	-41	-42	-47	-66	-77	29	26	23	27
30,000	50	36	30	34	36	19	10	-52	-38	-31	-36	-38	-57	-68	31	28	18	28
20,000	32	23	18	23	23	11	5	-33	-25	-19	-24	-24	-38	-45	22	21	12	19
DENVER TO PHOENIX																		
53,000	-24	-23	-8	-14	-17	-28	-34	22	22	8	13	15	5	0	17	15	512 N.MI. 11	15
40,000	-41	-33	-29	-28	-32	-50	-59	34	29	27	24	28	12	3	28	25	21	25
30,000	-34	-29	-21	-21	-25	-43	-52	28	25	20	18	22	7	-2	31	27	17	24
20,000	-20	-17	-15	-11	-16	-27	-33	18	16	14	10	14	3	-3	21	19	11	17
DENVER TO PORTLAND, ORE.																		
53,000	-32	-20	-10	-23	-20	-31	-36	31	19	10	22	20	10	6	15	13	854 N.MI. 10	12
40,000	-47	-32	-30	-37	-36	-52	-61	45	30	27	35	34	18	10	24	22	20	25
30,000	-44	-31	-25	-34	-33	-50	-60	41	28	23	32	30	14	6	27	25	18	25
20,000	-29	-20	-16	-22	-21	-33	-39	28	18	15	21	20	9	3	19	18	12	17
DENVER TO RAPID CITY																		
53,000	5	7	8	2	6	-4	-10	-9	-8	-8	-4	-7	-17	-23	18	15	270 N.MI. 12	15
40,000	7	9	15	6	9	-9	-18	-16	-13	-20	-11	-15	-33	-42	28	26	23	28
30,000	6	8	12	2	8	-11	-21	-13	-13	-15	-7	-12	-30	-40	32	29	20	29
20,000	2	4	8	2	4	-8	-16	-5	-7	-9	-4	-7	-19	-26	22	21	13	20
DENVER TO RENO																		
53,000	-34	-25	-13	-23	-22	-33	-40	33	25	12	22	22	12	7	16	14	687 N.MI. 10	13
40,000	-51	-38	-38	-40	-41	-58	-67	49	36	36	38	39	23	14	26	24	21	25
30,000	-45	-35	-29	-33	-34	-52	-62	42	33	27	31	32	16	7	29	27	18	25
20,000	-28	-22	-17	-20	-21	-33	-40	27	20	16	19	20	9	3	21	18	12	18
DENVER TO SALT LAKE CITY																		
53,000	-35	-25	-11	-24	-23	-35	-42	34	25	11	23	22	11	6	18	15	330 N.MI. 11	15
40,000	-54	-37	-38	-41	-42	-60	-71	52	35	35	39	40	22	12	29	26	23	28
30,000	-47	-35	-29	-35	-35	-54	-65	44	33	28	33	33	16	6	32	30	19	28
20,000	-30	-22	-17	-22	-22	-35	-42	29	21	16	21	21	9	2	22	20	13	19
DENVER TO SAN FRANCISCO																		
53,000	-33	-26	-12	-21	-22	-32	-39	31	25	12	21	21	12	7	16	13	828 N.MI. 10	13
40,000	-50	-38	-37	-38	-40	-56	-65	47	36	36	36	38	23	15	25	23	20	24
30,000	-44	-35	-28	-31	-33	-50	-59	40	33	26	29	31	16	8	28	25	17	24
20,000	-28	-21	-17	-18	-20	-32	-38	26	20	16	17	19	9	3	20	18	11	17
DENVER TO SEATTLE																		
53,000	-30	-18	-9	-22	-19	-29	-35	29	17	9	21	18	9	4	15	12	884 N.MI. 10	12
40,000	-45	-29	-27	-35	-33	-49	-58	42	27	24	33	31	15	7	23	21	20	24
30,000	-42	-28	-24	-34	-31	-48	-58	39	26	21	31	28	12	4	27	25	18	25
20,000	-29	-18	-15	-22	-20	-32	-38	27	17	14	21	19	8	2	19	17	12	17

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANOARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	DIRECT								RETURN													
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
DENVER TO SIOUX FALLS																			430 N.MI.			
53,000	28	21	13	18	19	9	4	-30	-22	-13	-19	-20	-31	-37	17	15	11	14				
40,000	47	32	36	31	36	19	9	-52	-35	-38	-34	-39	-57	-67	27	25	22	27				
30,000	38	29	28	26	30	13	3	-43	-32	-30	-30	-33	-51	-61	30	27	19	28				
20,000	24	19	17	18	19	7	1	-26	-20	-18	-20	-21	-33	-40	22	20	13	19				
DENVER TO TULSA																			476 N.MI.			
53,000	36	27	7	22	22	10	4	-38	-28	-8	-23	-23	-37	-44	18	16	11	15				
40,000	58	39	28	40	40	22	13	-63	-42	-29	-42	-43	-63	-73	29	26	21	26				
30,000	46	34	21	33	32	15	7	-50	-37	-22	-35	-34	-54	-64	30	27	17	27				
20,000	32	23	12	21	21	9	3	-34	-25	-13	-22	-22	-36	-44	21	19	11	18				
DENVER TO WASHINGTON, D.C.																			1289 N.MI.			
53,000	43	30	11	26	27	16	10	-44	-31	-12	-27	-28	-40	-46	14	13	9	12				
40,000	72	47	36	45	48	33	25	-74	-49	-37	-47	-50	-68	-78	22	20	18	22				
30,000	62	42	28	39	41	26	19	-65	-44	-29	-41	-43	-60	-71	23	22	14	22				
20,000	42	28	19	26	27	17	12	-43	-29	-19	-28	-28	-41	-48	17	17	10	16				
DENVER TO WICHITA																			379 N.MI.			
53,000	37	28	9	24	23	11	5	-38	-29	-9	-24	-24	-37	-44	18	16	12	15				
40,000	63	41	32	41	43	24	15	-66	-43	-33	-43	-45	-65	-76	29	26	22	27				
30,000	48	36	24	34	34	17	8	-52	-38	-25	-37	-36	-56	-67	31	28	18	27				
20,000	33	24	14	22	22	10	4	-35	-25	-15	-23	-23	-37	-45	22	20	12	19				
DES MOINES TO LOS ANGELES																			1254 N.MI.			
53,000	-34	-28	-11	-21	-22	-33	-39	32	27	10	20	22	12	8	14	12	9	12				
40,000	-57	-41	-36	-38	-42	-57	-65	53	39	35	35	40	26	19	22	20	17	21				
30,000	-47	-37	-27	-31	-34	-49	-57	43	34	26	29	32	18	11	25	22	14	20				
20,000	-29	-23	-17	-18	-21	-31	-37	27	22	16	17	20	11	6	17	16	10	15				
DES MOINES TO MINNEAPOLIS																			202 N.MI.			
53,000	-3	1	0	-2	-1	-11	-17	-1	-3	0	0	-1	-11	-17	18	16	12	15				
40,000	-2	1	-4	-5	-2	-20	-30	-9	-7	-2	-2	-5	-23	-32	28	26	24	30				
30,000	-2	-2	-3	-5	-3	-21	-31	-8	-3	-1	-1	-3	-22	-32	32	29	21	30				
20,000	-4	-2	0	-4	-2	-16	-23	-1	-1	-1	1	-1	-14	-21	23	22	14	22				
DES MOINES TO ST. LOUIS																			225 N.MI.			
53,000	28	20	10	18	18	7	1	-32	-22	-10	-19	-20	-32	-39	19	17	12	15				
40,000	43	30	26	31	32	14	4	-52	-35	-29	-35	-37	-57	-68	29	27	24	30				
30,000	39	27	21	27	27	9	-1	-46	-31	-22	-31	-31	-51	-62	32	29	19	30				
20,000	28	18	13	21	19	6	-1	-31	-20	-14	-23	-21	-36	-44	23	22	13	22				
DETROIT TO INDIANAPOLIS																			200 N.MI.			
53,000	-34	-21	-5	-21	-19	-33	-40	31	19	5	19	18	5	-1	19	17	13	16				
40,000	-53	-35	-22	-37	-36	-57	-68	44	30	18	32	31	11	1	29	28	24	30				
30,000	-50	-31	-19	-33	-32	-53	-64	42	26	17	29	27	8	-1	30	30	20	30				
20,000	-33	-19	-14	-21	-20	-36	-44	29	16	13	18	18	5	-3	23	23	14	23				
DETROIT TO LAND O LAKES																			344 N.MI.			
53,000	-32	-19	-13	-22	-21	-32	-38	30	18	13	20	19	9	4	17	15	12	15				
40,000	-50	-33	-38	-38	-40	-58	-67	44	29	35	34	36	18	8	27	25	24	28				
30,000	-48	-34	-32	-35	-37	-56	-67	42	31	30	31	33	15	5	30	29	21	29				
20,000	-34	-23	-21	-24	-25	-39	-47	31	21	20	22	23	10	2	23	22	14	22				
DETROIT TO LAS VEGAS																			1516 N.MI.			
53,000	-37	-28	-12	-23	-24	-35	-41	36	27	11	23	24	14	10	13	11	8	11				
40,000	-62	-43	-38	-42	-46	-60	-68	60	41	37	40	43	30	23	21	19	16	20				
30,000	-54	-39	-29	-36	-38	-53	-61	51	37	28	34	36	23	16	22	21	14	20				
20,000	-34	-25	-19	-23	-24	-35	-41	33	24	18	22	23	14	9	16	15	9	14				
DETROIT TO LOS ANGELES																			1715 N.MI.			
53,000	-37	-28	-11	-23	-24	-34	-40	35	28	11	22	23	14	10	12	11	8	10				
40,000	-61	-43	-37	-41	-44	-59	-66	58	41	35	38	42	29	23	20	18	16	19				
30,000	-52	-39	-28	-34	-37	-51	-59	49	36	27	32	35	22	16	22	20	13	19				
20,000	-33	-25	-18	-21	-23	-33	-39	32	23	17	20	22	14	9	15	14	9	13				
DETROIT TO LOUISVILLE																			266 N.MI.			
53,000	-25	-14	-1	-14	-13	-25	-32	20	12	0	12	10	-1	-7	18	17	12	16				
40,000	-38	-24	-10	-27	-24	-44	-55	25	17	6	20	17	-2	-12	29	28	24	29				
30,000	-35	-21	-10	-24	-21	-41	-52	24	15	8	18	15	-3	-12	29	30	20	30				
20,000	-22	-11	-8	-14	-13	-27	-35	17	8	7	11	10	-3	-10	23	23	13	22				

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*								STANDARD DEVIATION										
	DIRECT								RETURN										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT	
DETROIT TO MIAMI																			998 N.MI.
53,000	3	6	4	2	4	-5	-9	-9	-9	-5	-4	-6	-15	-20	14	14	9	14	
40,000	3	4	9	0	4	-10	-18	-16	-13	-11	-6	-11	-25	-33	22	22	17	22	
30,000	3	7	5	0	4	-9	-15	-14	-13	-6	-5	-9	-22	-29	19	21	14	21	
20,000	2	5	0	0	1	-8	-13	-7	-8	-1	-2	-4	-13	-19	16	16	9	15	
DETROIT TO MILWAUKEE																			206 N.MI.
53,000	-42	-28	-14	-27	-27	-40	-48	41	27	14	27	26	14	8	18	16	13	15	
40,000	-69	-46	-41	-48	-51	-70	-81	66	44	40	46	48	29	19	29	27	24	29	
30,000	-65	-43	-34	-44	-45	-66	-78	62	41	33	41	43	24	14	31	30	21	30	
20,000	-44	-29	-23	-30	-30	-46	-54	43	27	23	28	29	15	8	24	23	14	23	
DETROIT TO MINNEAPOLIS																			457 N.MI.
53,000	-39	-25	-15	-26	-25	-37	-44	38	24	14	25	24	14	8	17	15	12	14	
40,000	-62	-41	-43	-46	-48	-66	-76	59	39	42	43	45	28	19	26	24	23	28	
30,000	-59	-40	-36	-42	-43	-62	-73	56	37	35	39	41	23	14	29	28	20	28	
20,000	-40	-27	-23	-29	-29	-43	-51	39	25	23	27	28	15	8	22	21	13	21	
DETROIT TO NEW YORK																			441 N.MI.
53,000	44	29	13	27	27	15	9	-45	-30	-13	-28	-28	-42	-49	18	16	12	15	
40,000	71	47	38	47	50	30	21	-74	-49	-39	-50	-52	-72	-83	28	27	23	27	
30,000	68	44	32	42	45	26	16	-70	-46	-33	-45	-47	-68	-80	29	29	20	29	
20,000	46	31	22	28	30	17	10	-48	-32	-23	-30	-31	-47	-56	23	22	13	22	
DETROIT TO OMAHA																			608 N.MI.
53,000	-42	-29	-13	-27	-26	-39	-46	41	28	12	26	26	14	9	17	15	11	14	
40,000	-69	-46	-39	-47	-50	-68	-79	67	44	37	45	48	30	21	26	24	22	27	
30,000	-63	-42	-31	-42	-43	-63	-74	61	40	30	40	41	24	15	28	27	18	27	
20,000	-42	-28	-21	-28	-28	-42	-51	40	26	21	27	27	15	9	21	20	12	20	
DETROIT TO PHILADELPHIA																			393 N.MI.
53,000	41	28	12	25	26	14	8	-43	-29	-13	-26	-27	-40	-48	18	16	12	15	
40,000	68	45	36	43	47	28	18	-72	-48	-38	-47	-50	-70	-82	28	27	23	28	
30,000	65	42	30	39	42	23	14	-69	-45	-31	-42	-45	-66	-78	28	29	20	29	
20,000	44	30	21	26	29	15	9	-47	-32	-21	-28	-30	-46	-55	23	22	13	22	
DETROIT TO ROCHESTER, N.Y.																			256 N.MI.
53,000	43	27	12	28	27	14	8	-44	-28	-12	-29	-27	-41	-49	18	16	13	16	
40,000	69	45	37	48	49	29	19	-71	-47	-38	-50	-51	-71	-83	29	28	24	29	
30,000	66	40	32	44	44	24	14	-69	-43	-34	-46	-46	-68	-80	30	30	21	30	
20,000	45	27	22	29	29	15	8	-46	-28	-23	-31	-31	-47	-56	24	23	14	23	
DETROIT TO ST. LOUIS																			382 N.MI.
53,000	-40	-27	-8	-24	-24	-38	-45	38	25	7	23	22	10	4	18	16	12	15	
40,000	-64	-43	-28	-43	-44	-64	-75	59	40	25	40	40	21	11	28	26	23	28	
30,000	-60	-39	-23	-39	-38	-59	-71	55	35	21	35	35	16	7	29	29	19	29	
20,000	-40	-25	-17	-24	-25	-40	-49	37	23	17	22	23	10	3	22	22	13	21	
DETROIT TO ST. PETERSBURG																			860 N.MI.
53,000	-4	1	4	-1	1	-9	-14	-3	-5	-5	-1	-3	-12	-17	15	15	10	14	
40,000	-7	-2	6	-6	-2	-17	-25	-7	-7	-9	-1	-6	-21	-29	23	24	18	23	
30,000	-5	0	3	-4	-1	-15	-23	-6	-7	-4	-1	-5	-18	-25	21	23	15	23	
20,000	-4	1	0	-3	-1	-11	-17	-1	-4	-1	0	-1	-11	-17	18	17	10	16	
DETROIT TO SAN FRANCISCO																			1801 N.MI.
53,000	-35	-26	-14	-23	-24	-33	-38	34	25	13	23	23	15	11	12	10	8	10	
40,000	-57	-39	-40	-42	-44	-57	-64	54	38	39	39	42	30	23	19	17	16	19	
30,000	-50	-36	-32	-36	-38	-51	-59	47	34	31	33	35	23	17	21	19	14	19	
20,000	-33	-23	-20	-23	-24	-33	-39	31	22	19	22	23	14	10	15	14	9	13	
DETROIT TO WASHINGTON, D.C.																			352 N.MI.
53,000	34	25	12	21	22	10	5	-37	-26	-12	-22	-23	-36	-44	18	17	12	15	
40,000	59	39	33	35	41	22	12	-66	-43	-35	-40	-45	-65	-77	28	28	23	28	
30,000	56	37	25	31	36	17	8	-62	-41	-27	-36	-40	-61	-72	28	29	19	29	
20,000	39	28	17	21	25	11	4	-42	-30	-18	-24	-27	-43	-51	23	23	13	22	
EDMONTON TO GRAND PRAIRIE																			217 N.MI.
53,000	-29	-15	-10	-22	-18	-29	-34	28	15	10	21	18	8	3	16	14	11	13	
40,000	-34	-16	-13	-28	-23	-39	-47	33	15	12	26	21	5	-3	22	21	22	23	
30,000	-37	-21	-17	-32	-26	-45	-54	35	19	15	29	24	6	-3	26	26	23	28	
20,000	-26	-15	-11	-22	-18	-31	-38	25	14	11	21	17	5	-1	19	18	15	18	

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HEIGHT IN FEET	EQUIVALENT							HEADWINDS*						STANDARD DEVIATION				
	D I R E C T							R E T U R N						JAN	APR	JUL	OCT	
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
EDMONTON TO MINNEAPOLIS																		
53,000	29	15	12	23	19	11	7	-30	-16	-13	-23	-20	-29	-34	14	11	9	11
40,000	39	22	29	31	30	16	9	-41	-23	-32	-33	-32	-46	-54	19	18	19	22
30,000	39	23	26	32	30	15	7	-42	-25	-28	-34	-32	-47	-55	23	22	18	24
20,000	29	18	18	25	22	12	6	-30	-19	-19	-26	-23	-34	-40	16	15	12	16
EDMONTON TO MONTREAL																		
53,000	30	17	15	23	20	13	10	-31	-17	-15	-24	-21	-29	-33	11	9	8	10
40,000	41	25	34	34	34	22	16	-43	-27	-36	-36	-35	-47	-53	16	15	16	18
30,000	41	27	32	34	33	21	14	-44	-29	-33	-37	-35	-48	-55	19	18	15	19
20,000	29	19	22	24	24	15	10	-31	-20	-23	-25	-25	-34	-39	14	13	10	14
EDMONTON TO REGINA																		
53,000	29	15	12	23	19	10	5	-29	-15	-13	-24	-19	-29	-35	16	12	10	12
40,000	36	19	23	26	26	11	2	-37	-20	-25	-28	-28	-43	-51	21	20	22	24
30,000	38	21	22	32	28	11	2	-40	-23	-24	-34	-30	-47	-57	25	25	21	28
20,000	28	17	16	24	21	9	3	-29	-17	-17	-25	-22	-34	-40	18	17	14	18
EDMONTON TO SASKATOON																		
53,000	29	16	13	24	20	10	6	-29	-16	-14	-24	-20	-30	-36	16	13	11	13
40,000	35	20	23	28	26	11	3	-36	-21	-25	-29	-28	-43	-52	22	21	22	24
30,000	39	21	23	33	28	11	2	-40	-23	-24	-35	-30	-48	-58	26	25	22	29
20,000	27	17	16	24	21	9	3	-28	-18	-17	-25	-21	-34	-41	19	17	15	19
EDMONTON TO TORONTO																		
53,000	31	17	14	23	21	13	10	-32	-18	-15	-24	-21	-30	-34	12	10	8	10
40,000	43	26	34	34	34	22	15	-45	-28	-36	-37	-36	-49	-55	17	16	16	19
30,000	43	27	31	34	34	20	14	-46	-29	-32	-36	-36	-49	-57	20	19	16	20
20,000	31	20	21	25	24	15	10	-32	-21	-22	-26	-25	-34	-40	15	14	11	14
EDMONTON TO VANCOUVER																		
53,000	-17	-14	-12	-20	-16	-25	-30	15	13	11	19	15	6	1	16	13	11	12
40,000	-23	-18	-16	-28	-21	-37	-45	20	16	14	25	19	3	-5	23	21	22	24
30,000	-28	-21	-20	-31	-25	-43	-52	24	19	18	28	22	5	-5	27	27	23	28
20,000	-20	-15	-13	-21	-17	-30	-36	18	13	13	20	16	4	-3	20	19	15	19
EDMONTON TO WINNIPEG																		
53,000	29	15	14	24	20	11	7	-30	-16	-14	-24	-20	-30	-35	15	11	10	12
40,000	37	21	29	30	29	15	7	-38	-22	-30	-32	-31	-45	-53	20	19	20	23
30,000	40	23	27	32	30	14	6	-41	-24	-28	-34	-32	-48	-56	23	23	20	25
20,000	29	18	18	25	22	11	6	-30	-19	-19	-26	-23	-34	-40	17	16	13	17
EL PASO TO FT. WORTH																		
53,000	44	36	0	19	25	8	0	-45	-36	0	-20	-25	-42	-49	17	15	11	15
40,000	68	57	13	42	44	22	11	-70	-59	-14	-43	-46	-69	-81	28	26	20	23
30,000	56	47	8	31	33	13	5	-58	-49	-9	-33	-35	-58	-69	28	24	15	23
20,000	35	29	4	16	19	6	0	-36	-30	-5	-17	-20	-35	-44	19	17	10	16
EL PASO TO HOUSTON																		
53,000	41	33	-6	17	22	4	-5	-42	-35	5	-17	-23	-40	-47	16	15	11	15
40,000	63	55	8	41	42	19	9	-66	-57	-9	-42	-44	-66	-77	26	24	19	21
30,000	51	44	5	30	31	12	4	-54	-47	-6	-32	-33	-55	-65	25	23	14	21
20,000	33	27	-1	15	17	3	-2	-34	-28	0	-15	-18	-33	-41	18	16	9	15
EL PASO TO LOS ANGELES																		
53,000	-35	-31	-1	-19	-22	-35	-42	34	30	1	19	21	7	1	17	14	11	14
40,000	-56	-50	-20	-36	-39	-58	-69	54	47	18	35	37	20	11	26	24	19	23
30,000	-47	-42	-13	-28	-30	-49	-60	45	40	12	26	29	12	4	29	24	16	20
20,000	-30	-25	-5	-13	-16	-30	-38	28	24	4	12	15	4	-1	19	17	10	15
EL PASO TO MIDLAND																		
53,000	41	35	-2	19	23	6	-2	-42	-36	1	-19	-24	-41	-49	18	16	12	16
40,000	64	56	14	40	43	21	10	-67	-58	-15	-42	-44	-68	-80	30	27	21	25
30,000	54	46	10	30	33	13	4	-56	-48	-10	-32	-34	-57	-68	30	26	16	23
20,000	34	28	3	15	18	5	-1	-35	-29	-4	-15	-19	-35	-43	21	18	11	17
EL PASO TO PHOENIX																		
53,000	-35	-30	1	-14	-21	-36	-43	34	29	-1	18	20	5	-2	18	16	12	15
40,000	-57	-51	-16	-37	-39	-60	-72	54	48	14	35	37	17	7	29	26	21	25
30,000	-48	-42	-11	-28	-30	-50	-62	45	39	9	26	23	10	2	32	26	17	21
20,000	-30	-25	-2	-13	-15	-31	-39	29	24	2	12	15	2	-4	21	18	11	17

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
EL PASO TO SAN ANTONIO																		
53,000	38	31	-6	16	20	3	-5	-40	-33	5	-16	-22	-38	-45	17	15	11	15
40,000	59	51	9	39	39	18	7	-63	-55	-10	-40	-42	-64	-75	27	25	19	22
30,000	48	42	6	29	29	10	2	-52	-44	-6	-30	-31	-53	-63	27	24	15	22
20,000	31	25	-1	13	16	2	-3	-32	-26	0	-14	-17	-32	-40	19	16	10	16
EL PASO TO SAN DIEGO																		
53,000	-36	-32	-1	-19	-22	-36	-43	35	32	0	19	21	7	0	17	15	12	14
40,000	-57	-52	-19	-37	-40	-60	-71	55	50	18	35	39	20	11	27	24	19	23
30,000	-49	-43	-12	-28	-31	-50	-61	46	42	11	27	30	13	5	29	24	16	20
20,000	-30	-26	-4	-13	-16	-31	-39	29	25	4	12	16	4	-2	19	17	10	15
EL PASO TO SAN FRANCISCO																		
53,000	-33	-26	-3	-19	-20	-32	-38	32	25	2	18	19	7	1	16	13	10	13
40,000	-52	-44	-21	-34	-37	-54	-63	49	41	18	32	34	18	9	25	23	19	22
30,000	-44	-38	-15	-27	-29	-47	-57	41	36	13	25	27	11	4	27	23	16	20
20,000	-28	-22	-7	-13	-16	-28	-36	26	21	6	12	15	4	-1	19	17	10	15
EL PASO TO TUCSON																		
53,000	-38	-34	1	-20	-23	-38	-46	37	33	-1	19	22	6	-1	19	16	13	16
40,000	-61	-55	-16	-39	-42	-64	-76	58	53	15	37	40	19	9	30	27	21	25
30,000	-52	-46	-11	-29	-32	-53	-65	49	44	10	28	30	12	4	32	26	17	21
20,000	-32	-27	-3	-13	-17	-32	-41	31	26	2	13	16	3	-3	21	18	10	17
FAIRBANKS TO JUNEAU																		
53,000	19	5	2	10	8	-1	-5	-20	-5	-3	-11	-9	-18	-24	16	13	9	12
40,000	21	5	7	5	9	-4	-11	-23	-6	-8	-8	-11	-25	-32	20	18	19	20
30,000	18	2	5	4	7	-10	-19	-20	-4	-6	-7	-9	-26	-35	25	23	23	25
20,000	11	-1	3	2	3	-8	-14	-12	0	-4	-3	-4	-16	-22	20	17	14	16
FAIRBANKS TO SAN FRANCISCO																		
53,000	16	6	2	8	7	0	-3	-18	-7	-2	-9	-8	-16	-20	12	10	7	9
40,000	21	10	9	9	12	1	-5	-24	-13	-12	-13	-15	-27	-33	17	15	15	17
30,000	19	8	7	6	10	-3	-10	-23	-11	-9	-10	-13	-26	-33	20	19	16	19
20,000	11	2	6	3	5	-4	-9	-14	-4	-7	-5	-7	-16	-21	16	14	11	13
FAIRBANKS TO SEATTLE																		
53,000	19	6	3	11	9	2	-2	-21	-7	-4	-12	-10	-18	-23	13	11	8	10
40,000	24	9	10	11	13	1	-5	-26	-11	-12	-15	-15	-28	-34	17	16	16	18
30,000	21	6	8	8	11	-3	-11	-24	-9	-10	-12	-14	-28	-36	21	20	19	21
20,000	12	2	6	5	6	-4	-9	-14	-3	-7	-7	-7	-17	-23	17	15	12	14
FAIRBANKS TO WHITEHORSE																		
53,000	23	6	3	13	10	1	-3	-24	-7	-3	-14	-10	-21	-27	17	13	9	12
40,000	23	7	9	9	12	-2	-9	-24	-8	-10	-11	-13	-27	-34	20	17	19	20
30,000	20	5	6	8	10	-7	-16	-22	-7	-8	-11	-12	-28	-38	25	23	23	25
20,000	12	2	5	5	5	-6	-12	-14	-3	-5	-6	-6	-18	-24	20	17	14	16
FAYETTEVILLE TO NEW BERN																		
53,000	51	36	5	25	29	12	5	-52	-37	-5	-26	-30	-46	-54	15	15	10	14
40,000	76	55	20	48	49	28	18	-78	-57	-22	-50	-51	-73	-85	24	25	19	23
30,000	67	47	15	39	40	20	11	-69	-49	-15	-41	-42	-65	-76	23	24	15	24
20,000	44	32	11	23	26	13	7	-45	-33	-12	-24	-27	-43	-51	18	18	10	17
FAYETTEVILLE TO WILMINGTON, N.C.																		
53,000	51	36	4	25	29	12	5	-52	-37	-4	-26	-30	-46	-54	15	15	10	14
40,000	75	55	19	47	49	27	17	-77	-57	-20	-50	-51	-73	-84	24	25	19	23
30,000	66	47	14	38	40	19	10	-68	-49	-14	-40	-42	-64	-75	23	24	15	25
20,000	42	32	10	22	25	12	6	-44	-33	-11	-24	-26	-42	-50	18	18	10	17
FLINT TO NEW YORK																		
53,000	42	28	13	26	26	14	9	-43	-29	-13	-27	-27	-40	-47	17	16	12	15
40,000	68	45	38	45	48	29	20	-71	-48	-39	-48	-51	-70	-81	28	27	23	27
30,000	65	42	32	40	44	25	15	-68	-45	-33	-43	-46	-67	-78	29	29	20	28
20,000	44	30	22	27	29	16	9	-46	-31	-23	-29	-31	-46	-55	22	22	13	22
FT. LAUDERDALE TO NEW YORK																		
53,000	15	6	-3	8	5	-4	-9	-20	-10	3	-9	-8	-20	-26	14	15	9	14
40,000	17	15	-1	17	11	-3	-11	-29	-23	-1	-22	-18	-35	-44	22	23	17	22
30,000	16	10	2	14	9	-3	-10	-25	-16	-3	-18	-14	-29	-37	20	21	14	21
20,000	13	8	5	11	9	0	-5	-17	-11	-6	-12	-11	-21	-27	16	16	9	15

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
FT. LAUDERDALE TO WASHINGTON, D.C.															783 N.MI.			
53,000	8	2	-4	4	2	-8	-12	-13	-5	4	-6	-4	-15	-21	15	15	10	15
40,000	8	7	-5	10	4	-10	-18	-20	-16	3	-15	-11	-28	-37	23	24	17	23
30,000	7	2	-1	9	4	-9	-16	-16	-9	0	-13	-8	-23	-30	20	22	14	21
20,000	8	4	3	7	5	-4	-9	-12	-7	-4	-9	-7	-17	-23	17	16	9	15
FT. NELSON TO WATSON LAKE															205 N.MI.			
53,000	-30	-11	-6	-21	-16	-27	-34	29	11	6	20	15	5	0	17	14	10	13
40,000	-28	-13	-11	-22	-19	-33	-41	27	12	10	21	17	3	-5	21	20	20	21
30,000	-28	-16	-10	-20	-19	-35	-44	27	14	9	19	17	1	-8	23	24	22	24
20,000	-19	-11	-8	-16	-13	-25	-31	18	10	8	15	12	1	-5	19	17	14	16
FT. NELSON TO WHITEHORSE															393 N.MI.			
53,000	-29	-11	-6	-20	-15	-27	-33	29	10	5	20	15	5	0	16	14	9	12
40,000	-29	-15	-12	-23	-19	-34	-41	28	14	11	22	18	4	-3	20	19	19	21
30,000	-28	-16	-11	-21	-19	-35	-44	26	15	10	19	17	1	-7	23	23	22	24
20,000	-18	-11	-9	-15	-13	-24	-31	17	10	8	14	12	1	-5	19	16	14	16
FT. WAYNE TO NEW YORK															519 N.MI.			
53,000	47	30	12	29	28	15	9	-48	-31	-12	-29	-29	-43	-51	17	16	12	15
40,000	74	49	37	49	51	32	22	-77	-51	-38	-52	-53	-74	-85	27	26	23	27
30,000	71	45	31	44	46	27	18	-73	-48	-32	-46	-48	-69	-82	28	28	19	28
20,000	48	31	22	30	31	18	11	-50	-32	-22	-31	-32	-48	-57	22	22	13	21
FT. WILLIAM TO SAULT STE. MARIE															227 N.MI.			
53,000	32	19	15	23	21	11	6	-33	-19	-15	-24	-22	-33	-39	17	14	12	15
40,000	47	30	39	38	39	21	12	-50	-32	-41	-41	-41	-58	-68	26	24	23	28
30,000	45	31	35	37	37	18	8	-49	-33	-37	-39	-39	-58	-69	30	29	22	29
20,000	32	21	24	25	26	12	5	-34	-23	-25	-26	-27	-40	-48	22	21	15	21
FT. WILLIAM TO TORONTO															492 N.MI.			
53,000	31	19	14	22	21	11	6	-33	-20	-14	-23	-22	-33	-39	16	14	12	14
40,000	47	31	38	37	38	21	12	-52	-34	-40	-40	-41	-58	-68	25	24	22	27
30,000	46	32	33	35	36	19	9	-51	-35	-35	-38	-39	-58	-68	29	28	21	28
20,000	33	22	23	24	25	12	5	-35	-23	-24	-25	-26	-40	-47	22	21	14	21
FT. WILLIAM TO WINNIPEG															322 N.MI.			
53,000	-33	-18	-16	-24	-22	-32	-38	32	17	16	24	21	12	7	16	13	11	14
40,000	-46	-28	-41	-39	-39	-55	-64	45	27	40	37	37	21	12	23	22	22	28
30,000	-46	-30	-36	-37	-38	-55	-65	44	29	35	35	36	18	9	27	27	22	28
20,000	-33	-21	-25	-27	-26	-39	-46	32	20	25	26	25	13	6	20	19	14	20
FT. WORTH TO HOUSTON															212 N.MI.			
53,000	12	11	2	8	8	-3	-8	-17	-14	-3	-9	-10	-21	-28	18	17	11	16
40,000	13	16	7	17	13	-4	-13	-26	-25	-8	-22	-19	-37	-47	29	27	21	23
30,000	12	13	6	14	10	-4	-13	-21	-19	-7	-17	-15	-31	-41	27	26	15	25
20,000	9	9	-4	7	4	-7	-12	-13	-12	4	-8	-6	-19	-27	20	18	10	17
FT. WORTH TO LITTL ROCK															266 N.MI.			
53,000	44	34	0	21	24	8	0	-46	-35	-1	-21	-25	-43	-51	18	17	12	16
40,000	71	52	11	41	43	19	8	-74	-55	-12	-44	-46	-70	-83	29	28	21	25
30,000	60	44	7	30	33	11	2	-62	-46	-7	-33	-35	-60	-72	28	27	16	27
20,000	38	28	5	17	20	6	0	-39	-29	-6	-18	-21	-38	-47	21	19	11	19
FT. WORTH TO LOS ANGELES															1070 N.MI.			
53,000	-40	-33	-4	-21	-24	-37	-44	39	32	3	20	23	10	3	15	13	10	12
40,000	-62	-52	-22	-40	-43	-61	-71	59	50	21	39	41	24	16	24	22	17	20
30,000	-52	-44	-15	-31	-34	-52	-62	49	42	15	30	32	16	9	25	21	14	19
20,000	-33	-27	-8	-16	-19	-32	-39	31	26	7	15	18	8	3	17	15	9	14
FT. WORTH TO NEW ORLEANS															387 N.MI.			
53,000	40	32	-1	18	22	6	-1	-42	-33	1	-19	-23	-40	-47	17	16	11	15
40,000	56	50	9	40	39	17	7	-63	-54	-10	-42	-42	-64	-75	27	26	20	22
30,000	47	41	6	30	29	10	2	-52	-43	-7	-32	-32	-54	-64	25	25	15	24
20,000	30	26	-2	16	16	2	-4	-52	-27	1	-17	-18	-34	-41	19	18	10	17
FREDERICTON TO MONTREAL															303 N.MI.			
53,000	-41	-24	-16	-30	-27	-39	-46	40	23	15	29	26	14	9	18	16	13	15
40,000	-67	-43	-43	-54	-51	-72	-83	65	41	42	52	49	30	20	30	27	26	29
30,000	-63	-42	-42	-49	-48	-69	-81	60	39	40	46	46	25	15	36	32	24	30
20,000	-42	-28	-27	-34	-32	-47	-55	41	26	26	32	31	16	9	24	23	15	23

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT										STANDARD DEVIATION							
	O I R E C T					R E T U R N												
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
FREDERICTON TO QUEBEC																		
53,000	-36	-22	-16	-27	-25	-37	-43	35	22	16	26	24	13	7	19	16	13	16
40,000	-59	-39	-42	-50	-47	-67	-78	56	37	40	47	45	25	15	30	27	26	30
30,000	-55	-39	-41	-45	-45	-66	-77	51	36	39	41	42	21	10	36	33	24	31
20,000	-37	-25	-27	-31	-29	-45	-53	35	24	26	29	28	14	6	25	24	16	23
GANDER TO MONTREAL																		
53,000	-37	-21	-16	-30	-25	-36	-43	36	20	15	29	24	14	9	17	13	11	14
40,000	-60	-37	-43	-55	-48	-66	-75	57	35	41	53	46	29	20	25	23	22	25
30,000	-56	-37	-40	-50	-45	-63	-74	53	34	38	48	43	25	16	29	27	21	26
20,000	-39	-23	-26	-33	-30	-43	-50	37	22	25	32	28	16	9	21	20	14	20
GRAND JUNCTION TO LAS VEGAS																		
53,000	-29	-25	-11	-18	-20	-31	-38	27	24	11	17	19	9	3	18	15	11	15
40,000	-44	-37	-36	-34	-38	-55	-65	40	34	35	32	35	17	8	29	26	22	27
30,000	-39	-33	-27	-27	-30	-49	-59	34	30	26	24	28	11	2	32	29	19	25
20,000	-24	-20	-17	-15	-18	-31	-38	22	19	16	14	17	6	-1	22	20	12	18
GRAND RAPIDS TO LAND O LAKES																		
53,000	-28	-16	-12	-19	-18	-29	-35	26	15	11	18	17	6	1	18	15	12	15
40,000	-42	-28	-35	-34	-35	-53	-63	35	24	31	30	30	12	2	27	26	24	29
30,000	-41	-30	-29	-31	-32	-52	-62	33	26	27	27	28	9	-1	31	30	22	30
20,000	-30	-20	-19	-21	-22	-36	-44	26	18	17	19	20	6	-1	23	22	14	22
GREAT FALLS TO SALT LAKE CITY																		
53,000	3	-2	-7	1	-2	-11	-16	-6	1	6	-3	0	-10	-15	17	14	11	14
40,000	3	-3	-13	-4	-5	-22	-31	-9	-1	9	-1	0	-18	-27	26	24	23	27
30,000	1	-3	-11	1	-3	-21	-31	-8	-1	7	-6	-1	-20	-30	30	28	21	28
20,000	5	0	-6	1	-1	-13	-19	-8	-2	5	-3	-1	-14	-22	21	19	14	19
GREAT FALLS TO SPOKANE																		
53,000	-29	-18	-15	-25	-21	-31	-37	28	18	14	24	20	11	6	17	14	11	13
40,000	-41	-28	-31	-36	-34	-51	-61	39	26	29	34	32	15	6	25	24	23	28
30,000	-43	-28	-30	-38	-34	-53	-64	40	26	28	35	32	13	3	30	29	23	30
20,000	-29	-19	-19	-26	-23	-36	-44	28	18	19	25	22	9	2	21	20	15	20
GREENSBORO TO LOUISVILLE																		
53,000	-47	-32	-8	-24	-27	-43	-51	45	31	8	23	26	12	5	18	17	12	16
40,000	-73	-52	-27	-45	-48	-70	-82	68	48	26	41	45	24	14	28	28	22	28
30,000	-66	-46	-20	-38	-40	-63	-75	62	43	19	35	38	18	9	26	28	18	29
20,000	-42	-31	-14	-24	-26	-42	-51	40	30	13	22	25	11	5	22	21	12	21
GREENSBORO TO NEW YORK																		
53,000	38	22	2	22	20	6	0	-41	-24	-3	-24	-22	-37	-45	18	17	12	16
40,000	52	37	17	41	36	16	6	-60	-42	-20	-45	-41	-62	-74	28	28	23	28
30,000	49	33	17	36	32	14	5	-56	-38	-19	-39	-36	-57	-69	27	29	18	28
20,000	37	22	13	23	22	9	3	-40	-24	-14	-25	-24	-40	-49	22	22	12	21
GREENSBORO TO PITTSBURGH																		
53,000	0	-3	-6	1	-2	-13	-19	-7	0	5	-3	-1	-12	-18	18	18	12	16
40,000	-12	-7	-10	3	-7	-25	-35	-4	-2	7	-10	-2	-21	-31	28	29	23	28
30,000	-10	-6	-4	2	-4	-21	-31	-3	-1	1	-9	-3	-20	-30	26	29	18	29
20,000	-3	-7	-1	2	-2	-15	-23	-4	4	0	-5	-1	-14	-22	22	22	13	22
GREENSBORO TO WASHINGTON, D.C.																		
53,000	34	20	0	19	17	3	-3	-38	-23	0	-20	-19	-35	-43	18	18	12	17
40,000	45	32	11	37	30	10	0	-55	-38	-14	-41	-36	-58	-70	29	29	23	29
30,000	42	29	12	32	27	9	0	-50	-34	-14	-36	-32	-53	-64	27	29	18	29
20,000	33	18	10	20	19	6	-1	-36	-21	-11	-22	-21	-36	-46	22	22	12	21
GREENVILLE TO RICHMOND																		
53,000	44	29	1	22	23	7	0	-46	-31	-1	-23	-25	-42	-50	17	18	12	16
40,000	63	45	14	45	41	19	8	-68	-49	-16	-48	-45	-68	-80	27	29	22	28
30,000	57	40	13	38	35	15	6	-62	-43	-14	-40	-38	-61	-73	25	28	17	28
20,000	41	27	11	23	23	10	4	-44	-29	-12	-24	-25	-42	-51	21	21	12	20
GOOSE BAY TO MONTREAL																		
53,000	-31	-15	-12	-25	-20	-31	-37	29	14	11	24	19	9	4	16	13	12	14
40,000	-48	-25	-29	-44	-36	-53	-63	44	22	26	41	33	16	7	25	22	22	25
30,000	-45	-26	-28	-40	-34	-53	-63	40	22	24	37	31	13	3	28	28	22	27
20,000	-30	-15	-18	-25	-21	-35	-42	28	14	17	23	20	7	0	21	20	14	20

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	DIRECT							RETURN														
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
HALIFAX TO MONTREAL																			434 N.MI.			
53,000	-40	-24	-16	-29	-26	-39	-46	39	24	15	29	26	15	9	18	15	12	15				
40,000	-66	-44	-44	-54	-52	-71	-82	63	42	42	52	49	30	20	29	26	25	28				
30,000	-63	-43	-42	-48	-48	-69	-81	59	40	41	46	46	26	16	35	31	23	29				
20,000	-42	-29	-27	-33	-32	-47	-55	40	27	26	32	31	17	9	24	23	15	22				
HARTFORD TO LOS ANGELES																			2191 N.MI.			
53,000	-39	-29	-11	-24	-26	-36	-41	38	28	11	24	25	15	11	11	10	7	9				
40,000	-65	-45	-37	-44	-46	-60	-68	62	43	35	41	44	32	26	18	16	14	17				
30,000	-57	-41	-29	-37	-39	-53	-62	54	39	28	35	37	25	20	19	18	12	17				
20,000	-37	-27	-19	-24	-25	-35	-41	36	25	18	22	24	16	12	14	13	8	12				
HARTFORD TO PITTSBURGH																			350 N.MI.			
53,000	-48	-30	-11	-30	-29	-43	-51	47	29	11	29	28	14	8	18	17	12	15				
40,000	-75	-50	-37	-53	-53	-74	-85	72	48	35	51	51	31	20	29	28	24	28				
30,000	-72	-47	-33	-47	-48	-70	-82	69	44	31	45	46	26	16	30	30	20	29				
20,000	-49	-32	-22	-32	-32	-48	-58	48	30	22	30	31	17	10	23	23	13	22				
HARTFORD TO WASHINGTON, D.C.																			265 N.MI.			
53,000	-41	-23	-6	-26	-23	-38	-46	38	21	6	25	21	8	2	19	17	12	16				
40,000	-61	-41	-27	-47	-43	-65	-76	54	37	24	43	39	18	8	30	29	25	29				
30,000	-59	-39	-25	-41	-39	-61	-73	51	34	23	37	35	16	6	31	31	20	30				
20,000	-42	-25	-17	-27	-26	-42	-51	39	22	16	26	24	10	3	24	23	13	22				
HONOLULU TO LOS ANGELES																			2218 N.MI.			
53,000	19	21	7	13	14	7	3	-21	-22	-8	-13	-15	-24	-29	12	11	8	10				
40,000	33	31	23	25	28	18	13	-36	-34	-24	-26	-29	-40	-46	17	15	12	14				
30,000	25	23	15	17	19	11	6	-27	-24	-15	-18	-20	-30	-35	16	14	10	12				
20,000	13	10	4	6	8	2	-1	-14	-11	-5	-7	-8	-15	-19	12	10	7	8				
HONOLULU TO NEW YORK																			4323 N.MI.			
53,000	26	22	12	18	19	13	10	-28	-23	-12	-19	-20	-27	-31	9	8	6	7				
40,000	45	34	30	33	35	27	22	-48	-36	-32	-35	-37	-46	-51	13	12	10	12				
30,000	38	29	23	27	28	20	16	-41	-31	-23	-29	-30	-39	-45	13	12	9	12				
20,000	24	18	12	16	17	11	8	-26	-19	-13	-17	-18	-24	-28	10	9	6	8				
HONOLULU TO PORTLAND, ORE.																			2264 N.MI.			
53,000	11	15	11	12	12	5	1	-13	-16	-11	-13	-13	-20	-24	12	11	8	10				
40,000	27	23	18	23	22	12	7	-32	-26	-19	-26	-25	-36	-42	17	15	13	15				
30,000	22	20	13	18	18	8	3	-26	-23	-14	-21	-20	-31	-37	18	15	11	15				
20,000	14	13	4	11	10	3	-1	-16	-14	-5	-12	-11	-19	-23	13	11	8	10				
HONOLULU TO SAN FRANCISCO																			2083 N.MI.			
53,000	16	19	9	12	14	7	3	-18	-20	-10	-13	-15	-23	-27	13	11	8	10				
40,000	31	28	22	24	26	16	10	-34	-31	-23	-26	-28	-39	-45	18	16	13	15				
30,000	24	21	14	17	18	9	4	-26	-23	-15	-18	-20	-30	-36	17	15	10	13				
20,000	13	10	4	8	8	2	-2	-14	-11	-4	-8	-9	-16	-20	12	10	7	9				
HONOLULU TO SEATTLE																			2329 N.MI.			
53,000	10	14	11	12	11	5	1	-12	-15	-11	-13	-13	-20	-23	12	10	8	10				
40,000	26	22	17	23	21	11	6	-31	-25	-18	-26	-25	-35	-41	17	15	13	15				
30,000	21	20	12	19	18	8	3	-26	-23	-14	-21	-20	-31	-37	18	15	11	15				
20,000	14	13	4	12	10	3	-1	-16	-14	-5	-13	-12	-19	-24	13	11	8	10				
HONOLULU TO VANCOUVER																			2354 N.MI.			
53,000	8	13	10	11	11	4	0	-11	-14	-11	-12	-12	-19	-23	12	10	8	10				
40,000	24	20	15	22	20	10	5	-29	-24	-17	-25	-24	-34	-40	17	15	13	15				
30,000	20	19	11	19	17	7	2	-25	-22	-13	-22	-20	-30	-36	18	16	11	15				
20,000	14	13	4	12	10	3	-1	-16	-15	-5	-13	-12	-20	-24	13	11	8	11				
HOUSTON TO LAS VEGAS																			1072 N.MI.			
53,000	-38	-30	0	-19	-22	-35	-42	36	29	-1	18	21	6	0	14	13	9	13				
40,000	-59	-50	-17	-39	-41	-59	-69	55	47	16	37	38	21	12	23	22	17	20				
30,000	-49	-42	-12	-31	-32	-50	-60	45	39	11	29	29	14	7	24	21	13	19				
20,000	-31	-25	-4	-15	-17	-31	-38	29	24	3	14	16	5	0	17	15	9	14				
HOUSTON TO LOS ANGELES																			1205 N.MI.			
53,000	-39	-32	1	-18	-23	-36	-43	37	31	-2	18	22	7	-1	14	12	9	12				
40,000	-61	-53	-16	-39	-42	-60	-70	58	50	15	38	40	22	13	22	20	16	19				
30,000	-51	-44	-10	-30	-32	-50	-60	48	42	9	28	30	14	7	23	20	13	18				
20,000	-32	-26	-3	-14	-17	-31	-37	30	25	3	13	16	5	0	16	14	8	13				

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
MINUS SIGNS DENOTE HEADWINDS.THE BOEING COMPANY
TRANSPORT DIVISION

NO. 36-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	DIRECT								RETURN													
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
HOUSTON TO MIAMI																			828 N.MI.			
53,000	40	33	-6	15	22	2	-6	-41	-34	6	-16	-23	-39	-46	14	14	9	14				
40,000	57	55	1	34	39	15	3	-60	-57	-2	-36	-41	-61	-71	21	21	16	19				
30,000	46	42	2	26	29	10	2	-48	-43	-2	-27	-31	-48	-57	18	18	12	18				
20,000	27	24	-2	11	14	2	-3	-28	-25	2	-12	-15	-28	-34	14	14	8	12				
HOUSTON TO NASHVILLE																			581 N.MI.			
53,000	38	28	-4	16	19	3	-4	-41	-30	4	-18	-21	-37	-45	16	16	10	15				
40,000	61	42	4	34	35	13	2	-67	-48	-5	-38	-39	-62	-74	26	26	19	22				
30,000	52	35	3	26	27	7	-1	-57	-39	-4	-29	-30	-53	-64	25	24	15	25				
20,000	34	23	0	14	16	2	-3	-36	-25	0	-16	-17	-34	-42	19	18	10	17				
HOUSTON TO NEW ORLEANS																			262 N.MI.			
53,000	48	37	-8	18	25	2	-7	-49	-38	8	-19	-26	-45	-52	17	16	11	16				
40,000	71	61	2	43	46	19	5	-73	-63	-3	-45	-47	-72	-83	27	26	20	22				
30,000	59	48	2	32	34	11	2	-60	-49	-3	-33	-36	-59	-70	25	24	15	23				
20,000	36	29	-3	16	18	2	-4	-37	-30	3	-16	-19	-36	-44	18	17	10	16				
HOUSTON TO NEW YORK																			1238 N.MI.			
53,000	44	29	0	22	24	8	1	-46	-31	-1	-23	-26	-40	-47	14	13	9	12				
40,000	66	46	13	42	42	22	12	-71	-50	-15	-45	-45	-65	-76	21	22	17	20				
30,000	59	40	12	34	35	17	9	-63	-43	-13	-37	-38	-58	-68	21	21	13	21				
20,000	40	26	8	21	22	10	5	-42	-28	-8	-22	-23	-38	-46	16	16	9	15				
HOUSTON TO ST. LOUIS																			597 N.MI.			
53,000	20	15	-4	9	9	-2	-8	-25	-18	3	-10	-11	-25	-32	17	15	10	15				
40,000	35	22	0	16	17	-1	-9	-46	-30	-2	-22	-24	-44	-55	26	25	20	23				
30,000	30	18	0	12	13	-3	-11	-39	-24	-1	-16	-18	-38	-49	26	25	15	25				
20,000	19	12	0	7	8	-3	-9	-23	-15	0	-8	-10	-23	-31	19	18	10	17				
HOUSTON TO SAN FRANCISCO																			1431 N.MI.			
53,000	-37	-29	-2	-19	-22	-34	-40	35	28	1	18	21	8	2	13	11	9	11				
40,000	-57	-47	-20	-38	-40	-56	-65	53	44	18	36	37	22	14	21	19	16	18				
30,000	-48	-40	-14	-30	-31	-48	-57	44	38	13	28	29	15	8	22	20	13	18				
20,000	-30	-24	-6	-15	-17	-30	-36	28	23	6	14	16	6	2	16	14	8	13				
HOUSTON TO TULSA																			394 N.MI.			
53,000	-3	-1	-4	-3	-3	-13	-18	-3	-3	4	1	0	-10	-16	17	16	11	15				
40,000	0	-4	-7	-7	-5	-21	-30	-14	-6	5	1	-3	-20	-30	28	27	20	24				
30,000	1	-3	-6	-7	-4	-19	-27	-11	-4	5	3	-1	-17	-26	27	25	15	25				
20,000	-1	-3	2	-3	-1	-12	-18	-4	0	-3	2	-1	-12	-18	20	18	10	18				
HOUSTON TO WASHINGTON, D.C.																			1056 N.MI.			
53,000	44	31	-1	21	24	7	0	-46	-32	1	-22	-25	-41	-48	14	14	9	13				
40,000	67	48	10	42	42	21	10	-71	-51	-12	-45	-45	-66	-77	22	23	17	21				
30,000	59	40	9	33	34	15	7	-62	-43	-10	-36	-37	-58	-68	21	22	14	22				
20,000	39	26	6	20	21	8	3	-41	-28	-6	-21	-22	-38	-45	17	16	9	16				
HUNTINGTON TO WASHINGTON, D.C.																			260 N.MI.			
53,000	50	33	8	28	29	14	7	-51	-34	-8	-29	-29	-46	-54	18	17	12	16				
40,000	77	52	29	50	51	30	19	-79	-54	-31	-52	-53	-76	-89	29	29	23	29				
30,000	71	47	25	44	45	24	15	-73	-49	-26	-46	-47	-70	-83	27	30	19	29				
20,000	49	32	18	28	30	15	9	-50	-33	-18	-30	-31	-48	-58	23	23	13	22				
HUNTSVILLE TO LEXINGTON																			223 N.MI.			
53,000	20	14	-3	11	10	-2	-8	-26	-17	2	-13	-12	-26	-34	18	18	12	16				
40,000	33	20	2	22	18	-1	-11	-45	-28	-5	-28	-25	-47	-58	28	29	23	28				
30,000	29	18	3	18	16	-2	-11	-40	-24	-5	-23	-21	-41	-54	27	29	18	29				
20,000	23	12	4	11	11	-1	-8	-27	-15	-5	-13	-13	-28	-37	22	21	12	21				
HUNTSVILLE TO LOUISVILLE																			214 N.MI.			
53,000	8	5	-4	5	3	-8	-14	-14	-9	4	-7	-5	-18	-24	18	18	12	16				
40,000	14	6	-4	9	6	-12	-22	-28	-15	1	-16	-14	-34	-45	29	29	23	28				
30,000	13	6	-1	8	5	-12	-21	-25	-13	0	-13	-11	-31	-41	28	29	18	30				
20,000	12	4	1	5	5	-8	-14	-17	-7	-2	-7	-7	-21	-29	22	22	12	21				
HUNTSVILLE TO WASHINGTON, D.C.																			522 N.MI.			
53,000	46	30	2	24	25	9	2	-48	-32	-3	-25	-26	-42	-50	17	16	11	15				
40,000	68	47	17	46	44	22	12	-72	-51	-19	-49	-47	-70	-82	26	27	21	26				
30,000	61	41	15	39	38	18	9	-65	-44	-16	-41	-40	-63	-75	25	27	17	27				
20,000	43	28	12	24	25	11	5	-45	-29	-13	-25	-26	-43	-51	20	20	11	19				

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION					
	DIRECT								RETURN													
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
INDIANAPOLIS TO MEMPHIS																			331 N.MI.			
53,000	-30	-20	0	-16	-15	-29	-36	25	17	-1	14	13	1	-5	18	17	12	15				
40,000	-51	-32	-9	-31	-30	-51	-62	41	25	7	25	23	4	-6	28	28	22	27				
30,000	-46	-28	-7	-25	-24	-46	-58	37	22	6	21	20	2	-7	29	28	18	29				
20,000	-30	-18	-7	-14	-16	-30	-39	26	15	7	12	13	1	-6	22	21	12	21				
INDIANAPOLIS TO NASHVILLE																			217 N.MI.			
53,000	-9	-5	4	-4	-3	-14	-21	3	1	-5	2	0	-10	-16	19	17	12	16				
40,000	-18	-9	3	-11	-8	-28	-38	3	1	-6	4	0	-18	-28	29	28	23	29				
30,000	-16	-8	1	-9	-7	-26	-36	3	1	-3	3	0	-17	-26	29	29	19	30				
20,000	-10	-3	-1	-4	-4	-17	-25	4	0	0	1	1	-11	-19	23	22	13	22				
INDIANAPOLIS TO NEW YORK																			575 N.MI.			
53,000	48	31	11	29	29	15	9	-49	-32	-11	-30	-29	-44	-52	17	16	11	15				
40,000	76	50	35	50	51	32	23	-78	-52	-37	-52	-54	-74	-86	27	26	22	27				
30,000	71	46	30	45	46	27	18	-74	-48	-31	-47	-48	-69	-82	27	28	18	28				
20,000	49	31	21	30	31	18	11	-51	-32	-22	-31	-32	-48	-57	21	21	12	21				
INDIANAPOLIS TO PITTSBURGH																			282 N.MI.			
53,000	48	31	10	29	28	14	8	-49	-32	-11	-29	-29	-44	-52	18	17	12	16				
40,000	75	49	34	49	51	30	20	-77	-51	-35	-52	-53	-75	-86	29	28	24	29				
30,000	70	45	28	44	45	25	15	-72	-47	-29	-46	-47	-69	-82	29	30	19	30				
20,000	48	30	20	29	30	16	9	-50	-31	-21	-31	-31	-48	-58	23	23	13	22				
JACKSONVILLE TO MIAMI																			286 N.MI.			
53,000	8	12	1	4	6	-4	-9	-13	-15	-1	-6	-8	-20	-26	16	17	10	18				
40,000	10	10	6	7	8	-7	-15	-19	-19	-7	-11	-13	-29	-38	24	25	18	24				
30,000	8	15	4	5	8	-5	-11	-14	-20	-5	-8	-11	-24	-32	20	21	14	20				
20,000	7	7	-3	0	2	-7	-12	-9	-9	2	-1	-3	-13	-20	17	16	9	14				
JACKSONVILLE TO NEW ORLEANS																			447 N.MI.			
53,000	-50	-38	5	-21	-28	-46	-54	50	37	-6	20	27	4	-5	16	16	10	16				
40,000	-71	-62	-4	-44	-47	-71	-82	69	60	3	43	45	19	6	25	25	19	22				
30,000	-59	-48	-4	-34	-36	-58	-68	58	46	4	33	35	13	3	22	23	15	22				
20,000	-37	-30	-2	-18	-20	-36	-44	36	29	2	17	19	6	0	17	17	9	16				
JACKSONVILLE TO NEW YORK																			722 N.MI.			
53,000	26	15	-2	14	12	1	-5	-31	-18	2	-16	-15	-29	-36	15	16	10	15				
40,000	34	26	5	29	23	5	-4	-45	-33	-7	-34	-29	-48	-58	24	25	19	24				
30,000	31	21	7	24	20	5	-3	-40	-27	-8	-28	-25	-42	-52	23	25	15	24				
20,000	25	15	7	16	15	4	-2	-29	-18	-8	-18	-17	-30	-38	19	18	10	17				
JACKSONVILLE TO PITTSBURGH																			608 N.MI.			
53,000	5	1	-5	3	1	-9	-14	-12	-5	4	-5	-4	-15	-21	16	16	11	15				
40,000	2	2	-6	8	1	-15	-23	-17	-11	4	-15	-9	-27	-36	25	26	20	25				
30,000	3	0	-1	7	2	-12	-20	-15	-8	0	-13	-8	-24	-32	22	25	16	25				
20,000	6	0	1	5	3	-8	-14	-12	-4	-2	-8	-6	-17	-24	19	19	10	18				
JACKSONVILLE TO WASHINGTON, D.C.																			554 N.MI.			
53,000	20	11	-4	10	8	-3	-8	-25	-15	3	-12	-11	-25	-32	16	16	11	16				
40,000	25	19	0	23	16	-1	-10	-37	-28	-2	-28	-23	-42	-53	25	26	20	25				
30,000	23	15	3	19	14	-1	-9	-32	-21	-4	-23	-19	-37	-46	22	25	16	25				
20,000	20	11	5	12	11	0	-5	-24	-14	-5	-14	-13	-26	-34	19	19	10	18				
JACKSONVILLE TO WEST PALM BEACH																			238 N.MI.			
53,000	13	16	1	6	8	-3	-8	-17	-19	-1	-8	-10	-22	-30	16	17	10	18				
40,000	16	16	7	10	11	-4	-12	-25	-24	-7	-14	-17	-34	-43	25	26	18	25				
30,000	13	19	4	8	10	-2	-9	-19	-23	-5	-11	-14	-28	-36	20	22	15	21				
20,000	10	9	-2	2	3	-6	-11	-12	-11	2	-2	-5	-16	-22	17	17	9	14				
JUNEAU TO SEATTLE																			788 N.MI.			
53,000	20	8	4	11	10	1	-3	-21	-9	-5	-12	-11	-20	-25	15	13	10	11				
40,000	25	11	12	16	16	1	-6	-28	-14	-14	-19	-19	-33	-41	21	20	20	22				
30,000	23	9	11	10	13	-3	-12	-26	-12	-13	-15	-17	-33	-43	25	25	22	25				
20,000	13	4	8	7	8	-4	-10	-16	-5	-9	-10	-10	-22	-28	20	18	15	18				
KANSAS CITY TO LOS ANGELES																			1185 N.MI.			
53,000	-36	-30	-9	-22	-24	-35	-41	35	29	9	21	23	12	7	14	12	9	12				
40,000	-60	-45	-33	-39	-43	-59	-68	57	43	32	37	41	27	19	23	21	17	21				
30,000	-50	-40	-24	-32	-35	-51	-60	47	37	23	30	33	19	12	25	22	14	20				
20,000	-31	-25	-15	-18	-21	-32	-39	30	24	15	17	20	11	6	17	15	9	15				

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*								STANDARD DEVIATION									
	DIRECT				RETURN													
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
KANSAS CITY TO MINNEAPOLIS																		
53,000	2	4	1	1	2	-8	-14	-6	-6	-1	-3	-4	-14	-20	18	16	12	15
40,000	4	5	0	0	2	-15	-25	-16	-10	-5	-6	-9	-27	-37	28	25	23	28
30,000	4	2	1	0	2	-16	-26	-14	-8	-4	-5	-7	-25	-36	31	28	20	29
20,000	0	1	2	-1	1	-12	-19	-5	-4	-4	-1	-3	-16	-23	22	21	13	21
KANSAS CITY TO NEW YORK																		
53,000	47	31	11	28	28	16	10	-47	-32	-11	-28	-29	-42	-49	15	14	10	13
40,000	74	49	34	48	50	33	24	-76	-51	-36	-51	-52	-71	-82	24	23	20	24
30,000	68	45	28	43	44	27	19	-71	-47	-29	-45	-46	-66	-77	25	24	16	25
20,000	46	30	20	28	29	18	12	-48	-31	-21	-30	-31	-45	-53	19	19	11	18
KANSAS CITY TO PHOENIX																		
53,000	-38	-32	-8	-21	-24	-37	-43	36	31	7	21	23	11	6	16	13	10	13
40,000	-64	-48	-29	-40	-44	-62	-72	60	45	28	37	41	25	17	25	23	19	23
30,000	-52	-41	-21	-31	-34	-52	-63	49	39	20	29	32	17	10	27	23	15	22
20,000	-32	-26	-14	-18	-21	-33	-40	30	24	13	17	20	10	4	19	17	10	16
KANSAS CITY TO WASHINGTON, D.C.																		
53,000	47	32	10	27	28	15	9	-48	-33	-10	-28	-29	-43	-51	16	15	10	13
40,000	75	51	32	48	50	32	23	-77	-52	-34	-50	-52	-72	-83	25	24	20	25
30,000	68	45	25	42	43	25	17	-70	-47	-26	-44	-45	-66	-78	25	25	16	25
20,000	46	30	18	28	29	16	11	-48	-32	-19	-29	-30	-45	-54	19	19	11	19
KNOXVILLE TO MEMPHIS																		
53,000	-52	-37	-3	-26	-29	-47	-55	51	36	3	25	28	11	3	18	17	11	16
40,000	-80	-57	-19	-51	-51	-76	-89	78	55	17	49	49	25	14	28	29	22	27
30,000	-70	-49	-13	-41	-42	-67	-79	68	47	12	39	40	17	7	27	28	17	29
20,000	-46	-33	-10	-24	-26	-44	-53	45	32	10	23	25	11	5	21	21	11	20
KNOXVILLE TO NEW YORK																		
53,000	45	28	4	25	25	10	3	-47	-29	-5	-26	-26	-42	-49	17	16	11	15
40,000	64	44	22	47	43	23	14	-70	-48	-24	-49	-47	-68	-80	27	27	22	26
30,000	60	40	20	40	38	20	11	-65	-44	-21	-43	-41	-63	-75	26	27	17	27
20,000	43	26	15	26	25	13	6	-45	-28	-16	-27	-27	-43	-52	21	21	12	20
KNOXVILLE TO PITTSBURG																		
53,000	24	17	0	16	14	2	-4	-33	-19	0	-18	-17	-31	-39	18	17	12	16
40,000	37	26	8	30	25	6	-4	-49	-32	-11	-36	-31	-52	-63	28	28	23	28
30,000	35	23	10	26	22	5	-4	-45	-29	-12	-31	-27	-48	-59	26	29	18	29
20,000	26	13	8	17	15	2	-4	-31	-17	-9	-19	-17	-32	-41	22	22	12	21
KNOXVILLE TO WASHINGTON, D.C.																		
53,000	46	30	3	24	25	10	2	-48	-31	-4	-25	-26	-43	-51	17	17	12	16
40,000	67	46	19	47	44	22	12	-72	-50	-21	-49	-47	-70	-82	27	28	22	27
30,000	61	41	17	40	38	18	10	-65	-44	-18	-42	-41	-64	-76	25	28	17	28
20,000	43	27	13	25	25	12	5	-45	-29	-14	-26	-26	-43	-52	21	21	12	21
KODIAK TO SEATTLE																		
53,000	23	11	7	16	13	5	1	-24	-12	-7	-17	-14	-23	-28	14	11	9	11
40,000	33	21	20	25	24	12	5	-35	-23	-21	-28	-27	-40	-47	19	18	18	20
30,000	31	19	17	20	21	6	-2	-34	-22	-19	-24	-24	-40	-48	23	23	20	23
20,000	19	9	12	14	13	2	-4	-21	-11	-13	-16	-15	-26	-32	19	16	14	16
LAND O LAKES TO NEW YORK																		
53,000	36	24	14	24	24	13	8	-38	-25	-14	-25	-25	-36	-42	16	14	11	13
40,000	58	39	39	41	44	27	18	-62	-41	-41	-44	-47	-64	-74	25	24	21	25
30,000	56	38	33	37	40	23	14	-60	-40	-35	-41	-43	-61	-71	27	27	19	26
20,000	38	26	23	25	27	15	9	-41	-28	-23	-27	-29	-42	-50	21	20	13	20
LAS VEGAS TO LOS ANGELES																		
53,000	-25	-24	-9	-16	-18	-29	-36	23	23	9	15	16	6	0	19	16	12	15
40,000	-38	-32	-33	-28	-33	-51	-60	33	28	32	26	30	12	2	29	27	22	26
30,000	-32	-29	-21	-22	-25	-43	-53	28	25	20	20	23	6	-4	32	28	20	25
20,000	-20	-18	-13	-11	-15	-28	-35	18	17	13	10	14	2	-5	23	21	13	18
LAS VEGAS TO PHOENIX																		
53,000	25	18	0	14	13	1	-5	-27	-20	0	-15	-14	-27	-35	19	16	12	15
40,000	38	32	9	24	24	6	-4	-43	-36	-12	-27	-28	-48	-59	30	27	22	26
30,000	31	28	7	19	19	2	-7	-36	-31	-9	-21	-22	-42	-54	33	28	19	24
20,000	20	16	2	9	10	-2	-8	-23	-17	-2	-10	-12	-26	-34	22	20	12	18

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
LAS VEGAS TO SACRAMENTO																		
53,000	-32	-23	-6	-19	-19	-31	-39	31	23	5	18	18	7	1	18	15	11	14
40,000	-48	-38	-24	-32	-35	-54	-64	45	36	21	30	32	14	5	28	26	22	26
30,000	-42	-35	-17	-28	-29	-49	-59	39	33	15	26	27	9	-1	31	28	21	26
20,000	-27	-21	-10	-14	-17	-31	-39	25	19	10	13	16	3	-3	23	21	13	19
LAS VEGAS TO SALT LAKE CITY																		
53,000	10	12	11	8	10	0	-5	-13	-14	-11	-9	-12	-22	-27	18	15	11	15
40,000	14	14	26	15	18	-1	-10	-21	-18	-29	-20	-22	-40	-49	29	26	23	27
30,000	12	12	19	9	14	-4	-15	-18	-17	-21	-13	-18	-35	-45	32	29	20	27
20,000	8	8	13	6	9	-3	-10	-11	-10	-13	-8	-11	-23	-30	23	20	13	19
LAS VEGAS TO SAN FRANCISCO																		
53,000	-33	-25	-8	-20	-20	-33	-40	32	25	7	19	20	8	3	18	15	11	14
40,000	-50	-40	-27	-34	-37	-56	-66	47	38	25	32	35	17	8	28	26	22	26
30,000	-43	-37	-20	-28	-31	-50	-60	41	35	18	27	29	11	2	31	28	21	26
20,000	-28	-22	-12	-15	-18	-31	-39	26	21	11	14	17	5	-2	23	20	13	18
LITTLE ROCK TO ST. LOUIS																		
53,000	14	11	-2	8	7	-4	-9	-20	-15	1	-10	-10	-22	-29	19	17	12	16
40,000	29	16	1	13	14	-5	-15	-41	-24	-4	-20	-21	-42	-53	29	28	23	27
30,000	25	14	1	10	11	-7	-16	-35	-20	-2	-16	-16	-37	-49	30	28	18	30
20,000	17	9	3	6	8	-5	-11	-21	-12	-4	-8	-10	-24	-32	22	21	12	20
LOS ANGELES TO MIAMI																		
53,000	39	32	-3	17	23	6	-1	-40	-33	2	-18	-24	-37	-42	11	10	7	10
40,000	58	52	10	37	41	22	12	-61	-55	-12	-38	-43	-59	-67	17	16	13	15
30,000	47	42	7	28	31	15	8	-50	-44	-8	-29	-33	-48	-56	17	15	10	14
20,000	29	25	1	13	17	5	1	-30	-26	-2	-14	-18	-29	-35	12	11	6	10
LOS ANGELES TO MONTREAL																		
53,000	33	25	12	22	22	14	11	-35	-26	-13	-23	-23	-32	-37	11	10	7	9
40,000	54	38	38	38	41	30	24	-57	-40	-39	-41	-44	-56	-63	18	16	14	17
30,000	48	34	30	33	35	24	18	-51	-36	-31	-35	-37	-50	-58	20	18	13	17
20,000	31	22	20	21	23	15	11	-33	-23	-20	-23	-24	-33	-38	14	13	8	13
LOS ANGELES TO NEW ORLEANS																		
53,000	40	33	0	19	24	8	1	-41	-33	0	-20	-25	-38	-44	13	12	9	11
40,000	60	52	15	39	42	24	15	-63	-54	-17	-41	-44	-61	-71	21	19	15	17
30,000	50	43	11	30	32	16	9	-53	-45	-11	-31	-34	-51	-60	21	19	12	17
20,000	32	26	3	15	18	6	2	-33	-27	-4	-16	-18	-32	-38	15	13	8	12
LOS ANGELES TO NEW YORK																		
53,000	39	30	10	24	25	15	10	-41	-30	-11	-25	-26	-37	-42	11	10	7	9
40,000	64	45	34	42	45	32	26	-67	-47	-36	-44	-47	-61	-69	18	17	14	17
30,000	55	40	26	35	37	25	19	-58	-42	-27	-38	-39	-54	-63	19	18	12	17
20,000	37	26	18	22	24	16	12	-38	-27	-18	-23	-25	-36	-42	14	13	8	13
LOS ANGELES TO OKLAHOMA CITY																		
53,000	38	32	5	21	24	11	5	-39	-33	-6	-22	-25	-37	-44	15	13	10	13
40,000	59	48	26	39	42	26	18	-62	-50	-27	-41	-44	-61	-71	24	22	17	21
30,000	49	41	19	30	33	18	11	-52	-43	-20	-32	-34	-52	-62	26	22	14	20
20,000	31	26	11	16	19	9	4	-33	-27	-12	-17	-20	-32	-40	18	16	10	15
LOS ANGELES TO PHILADELPHIA																		
53,000	40	30	10	24	26	15	10	-41	-31	-10	-25	-26	-37	-43	12	10	8	10
40,000	65	46	33	42	45	32	26	-67	-48	-35	-44	-47	-62	-70	18	17	14	17
30,000	56	41	25	35	37	25	19	-59	-43	-26	-37	-39	-54	-63	19	18	12	17
20,000	37	26	17	22	24	16	11	-38	-28	-17	-23	-25	-36	-42	14	13	8	13
LOS ANGELES TO PHOENIX																		
53,000	34	29	4	19	21	8	1	-35	-30	-4	-20	-21	-35	-43	18	16	12	15
40,000	52	45	24	34	38	20	10	-54	-47	-25	-35	-39	-58	-69	28	26	21	25
30,000	43	39	16	26	29	12	3	-46	-41	-17	-28	-31	-50	-61	31	27	18	23
20,000	27	23	8	12	16	4	-2	-29	-24	-9	-13	-17	-30	-39	22	19	12	17
LOS ANGELES TO PITTSBURGH																		
53,000	39	30	10	23	25	14	10	-40	-30	-10	-24	-25	-36	-42	12	11	8	10
40,000	62	44	33	41	44	31	24	-65	-46	-35	-43	-46	-61	-69	19	18	15	18
30,000	53	39	25	34	36	23	17	-56	-42	-26	-36	-38	-53	-62	21	19	12	18
20,000	35	25	17	21	23	14	10	-36	-26	-17	-22	-24	-35	-41	15	14	8	13

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HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION				
	DIRECT								RETURN								JAN	APR	JUL	OCT	
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85							
LOS ANGELES TO PORTLAND, ORE.																		725 N.MI.			
53,000	-16	-7	3	-6	-6	-16	-22	13	5	-3	5	4	-5	-10	16	14	10	12			
40,000	-23	-17	0	-13	-13	-30	-39	17	13	-4	9	8	-8	-17	25	24	21	25			
30,000	-21	-16	-1	-13	-12	-30	-40	15	12	-1	9	8	-9	-17	28	26	20	25			
20,000	-13	-8	-1	-5	-6	-18	-25	10	6	0	4	4	-7	-13	21	19	12	18			
LOS ANGELES TO SACRAMENTO																		309 N.MI.			
53,000	-21	-13	2	-10	-9	-21	-28	19	11	-2	8	8	-3	-8	18	16	12	14			
40,000	-31	-26	-2	-17	-18	-38	-48	26	22	-2	14	14	-4	-14	28	26	22	26			
30,000	-27	-24	-4	-15	-16	-36	-46	22	20	2	12	13	-5	-14	31	28	21	26			
20,000	-17	-12	-2	-7	-8	-22	-30	15	10	1	6	7	-5	-12	23	21	13	18			
LOS ANGELES TO ST. LOUIS																		1380 N.MI.			
53,000	37	30	8	22	24	13	8	-38	-31	-9	-23	-25	-36	-42	14	12	9	11			
40,000	60	45	31	39	43	28	21	-63	-47	-32	-41	-45	-61	-69	22	20	16	20			
30,000	50	39	22	31	34	20	14	-53	-41	-23	-33	-36	-52	-61	23	21	13	19			
20,000	32	25	14	18	21	12	7	-33	-26	-15	-19	-22	-33	-40	16	15	9	14			
LOS ANGELES TO SALT LAKE CITY																		513 N.MI.			
53,000	15	16	11	11	13	3	-2	-17	-17	-11	-12	-14	-24	-29	17	15	11	14			
40,000	21	18	30	20	23	6	-4	-27	-23	-32	-24	-27	-43	-52	27	25	21	25			
30,000	18	17	20	14	17	1	-9	-24	-21	-22	-17	-21	-37	-47	30	27	19	25			
20,000	12	12	13	8	11	0	-7	-15	-13	-14	-10	-13	-24	-31	22	19	12	18			
LOS ANGELES TO SAN FRANCISCO																		295 N.MI.			
53,000	-26	-18	-1	-13	-14	-26	-33	25	16	0	12	12	1	-5	19	16	12	14			
40,000	-39	-32	-10	-23	-25	-45	-55	35	29	7	20	22	4	-6	28	26	22	26			
30,000	-33	-30	-9	-19	-22	-41	-51	30	27	7	17	19	1	-8	31	28	21	26			
20,000	-22	-16	-5	-10	-12	-25	-33	20	14	5	8	11	-2	-8	23	21	13	18			
LOS ANGELES TO SEATTLE																		830 N.MI.			
53,000	-15	-6	3	-5	-5	-15	-20	12	4	-4	4	3	-6	-10	15	13	10	12			
40,000	-20	-15	1	-12	-11	-28	-37	14	11	-5	7	6	-9	-18	24	23	20	24			
30,000	-19	-14	0	-12	-11	-28	-37	13	10	-2	8	6	-10	-18	27	25	19	25			
20,000	-12	-6	0	-5	-5	-17	-24	9	4	-1	3	3	-8	-14	20	18	12	17			
LOS ANGELES TO SYRACUSE																		2036 N.MI.			
53,000	36	27	11	23	24	15	10	-37	-28	-12	-23	-25	-34	-39	11	10	8	10			
40,000	59	41	36	40	43	31	25	-62	-43	-38	-42	-45	-59	-66	18	17	15	18			
30,000	51	36	28	34	36	24	18	-54	-39	-29	-36	-38	-52	-60	20	18	12	18			
20,000	33	24	19	21	23	15	11	-35	-25	-19	-23	-24	-34	-40	14	13	8	13			
LOS ANGELES TO TAMPA																		1870 N.MI.			
53,000	40	33	-1	19	25	7	0	-42	-34	1	-19	-25	-38	-44	12	11	8	10			
40,000	60	53	13	39	42	23	14	-63	-55	-14	-41	-44	-61	-69	18	17	13	16			
30,000	50	43	9	30	32	16	9	-52	-45	-10	-31	-34	-51	-59	18	17	11	15			
20,000	31	26	3	15	18	7	2	-33	-27	-3	-15	-19	-31	-37	13	12	7	11			
LOS ANGELES TO TUCSON																		390 N.MI.			
53,000	33	28	1	18	20	6	0	-34	-29	-2	-19	-20	-34	-41	18	15	12	14			
40,000	51	45	18	32	35	17	8	-53	-47	-20	-34	-38	-57	-67	27	25	20	24			
30,000	42	38	11	25	27	10	2	-45	-40	-13	-26	-29	-48	-59	30	25	18	22			
20,000	27	22	5	11	15	3	-3	-28	-24	-5	-12	-15	-29	-38	21	18	11	16			
LOUISVILLE TO MEMPHIS																		277 N.MI.			
53,000	-40	-28	-1	-20	-21	-37	-45	36	25	1	19	19	5	-1	18	17	12	16			
40,000	-66	-43	-14	-40	-40	-63	-75	59	38	11	36	35	14	3	28	28	22	27			
30,000	-58	-37	-10	-33	-32	-56	-68	52	33	9	29	28	9	0	28	28	18	29			
20,000	-39	-25	-9	-19	-21	-37	-47	36	22	8	18	19	6	-1	22	21	12	21			
LOUISVILLE TO NEW YORK																		573 N.MI.			
53,000	49	31	9	29	28	14	7	-50	-32	-9	-29	-29	-44	-52	17	16	11	15			
40,000	74	49	31	50	50	30	20	-77	-52	-32	-52	-52	-73	-85	27	26	22	26			
30,000	69	45	27	44	44	25	17	-72	-48	-28	-46	-46	-68	-81	26	28	18	27			
20,000	48	30	19	29	30	16	10	-50	-32	-20	-30	-31	-47	-56	21	21	12	20			
LOUISVILLE TO ST. LOUIS																		220 N.MI.			
53,000	-48	-34	-9	-27	-28	-44	-52	47	33	9	26	28	13	7	19	17	12	16			
40,000	-76	-53	-31	-49	-51	-73	-86	73	51	30	47	49	28	18	29	28	24	29			
30,000	-69	-47	-23	-42	-43	-66	-79	66	45	23	40	41	21	11	30	29	19	30			
20,000	-46	-31	-17	-28	-28	-45	-55	44	30	17	27	27	14	7	23	22	13	22			

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--INDICATES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	DIRECT							RETURN										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
LOUISVILLE TO ST. PETERSBURG																		
53,000	7	9	4	5	6	-3	-8	-14	-12	-5	-6	-9	-19	-24	15	16	634 N.MI.	15
40,000	6	9	9	5	8	-8	-16	-20	-18	-11	-12	-15	-30	-39	24	25	19	23
30,000	6	11	5	5	6	-7	-15	-16	-17	-6	-9	-11	-26	-34	22	23	15	23
20,000	3	6	3	2	3	-6	-12	-8	-9	-3	-4	-6	-16	-22	18	18	10	16
LOUISVILLE TO TAMPA																		
53,000	8	9	4	5	6	-3	-8	-14	-13	-5	-7	-9	-19	-25	15	16	634 N.MI.	15
40,000	7	10	9	6	8	-7	-15	-21	-19	-11	-12	-15	-31	-40	24	25	19	23
30,000	7	11	5	5	7	-7	-14	-17	-17	-6	-10	-12	-27	-35	22	23	15	23
20,000	4	7	3	2	4	-6	-12	-8	-10	-3	-4	-6	-16	-22	18	18	10	16
LOUISVILLE TO WASHINGTON, D.C.																		
53,000	50	33	8	28	29	14	7	-51	-34	-8	-29	-29	-45	-54	18	17	410 N.MI.	15
40,000	77	52	29	50	51	30	20	-79	-54	-31	-52	-53	-75	-87	28	28	22	27
30,000	71	47	24	43	44	24	15	-73	-49	-25	-46	-46	-69	-82	26	28	18	28
20,000	48	32	18	28	29	16	9	-50	-33	-18	-29	-30	-47	-57	22	22	12	21
MEDFORD TO SACRAMENTO																		
53,000	14	6	-3	5	5	-6	-11	-17	-8	2	-7	-6	-18	-24	18	15	243 N.MI.	14
40,000	18	14	-1	9	10	-9	-19	-24	-18	-3	-13	-14	-34	-44	29	27	24	29
30,000	17	13	0	11	9	-10	-20	-23	-17	-2	-15	-13	-34	-45	33	29	23	30
20,000	11	7	2	4	5	-8	-15	-14	-9	-3	-6	-7	-21	-29	25	22	14	21
MEDFORD TO SAN FRANCISCO																		
53,000	8	1	-6	1	0	-10	-15	-11	-3	5	-2	-2	-13	-19	18	15	286 N.MI.	14
40,000	8	7	-7	1	2	-17	-26	-15	-11	4	-6	-7	-25	-36	29	27	23	28
30,000	8	6	-5	4	3	-16	-26	-14	-11	2	-8	-7	-27	-37	32	29	23	29
20,000	5	3	-1	0	1	-12	-19	-8	-5	0	-2	-3	-17	-25	24	22	14	20
MEMPHIS TO NEW ORLEANS																		
53,000	-10	-4	6	-2	-1	-13	-19	3	0	-6	0	-1	-11	-17	17	17	304 N.MI.	16
40,000	-24	-8	6	-5	-7	-25	-35	9	-2	-7	-1	-1	-18	-26	27	28	21	24
30,000	-19	-6	3	-4	-5	-23	-32	9	-1	-3	-1	0	-15	-23	26	26	16	26
20,000	-11	-3	4	-2	-2	-14	-21	7	0	-5	0	-1	-11	-17	20	19	11	18
MEMPHIS TO ST. LOUIS																		
53,000	-7	-5	-5	-3	-5	-15	-21	1	1	5	1	2	-8	-14	19	17	222 N.MI.	16
40,000	-6	-9	-10	-8	-8	-26	-36	-10	0	8	1	0	-19	-29	29	29	23	28
30,000	-5	-7	-7	-6	-6	-24	-34	-8	0	5	1	0	-18	-28	30	29	18	30
20,000	-2	-4	-3	-5	-3	-16	-23	-4	1	2	3	1	-12	-19	22	22	12	21
MEMPHIS TO SHREVEPORT																		
53,000	-42	-31	2	-19	-22	-39	-47	39	29	-2	18	20	4	-3	18	17	247 N.MI.	16
40,000	-70	-48	-7	-39	-40	-65	-78	65	44	6	35	36	13	2	29	29	21	25
30,000	-59	-40	-5	-30	-31	-56	-68	55	36	4	26	28	7	-2	28	27	17	28
20,000	-37	-26	-1	-17	-18	-36	-45	35	24	1	15	17	2	-4	21	20	11	19
MEMPHIS TO WASHINGTON, D.C.																		
53,000	48	32	4	25	27	11	4	-50	-34	-4	-26	-28	-44	-52	16	16	660 N.MI.	14
40,000	73	50	21	48	47	26	16	-77	-53	-22	-50	-50	-72	-84	25	26	20	25
30,000	66	44	17	40	40	20	11	-69	-47	-18	-42	-42	-65	-77	24	26	16	26
20,000	45	30	13	25	26	13	7	-47	-31	-14	-26	-27	-44	-53	20	19	11	19
MIAMI TO MINNEAPOLIS																		
53,000	-25	-19	-6	-13	-15	-24	-30	20	16	5	11	12	4	0	13	13	1305 N.MI.	12
40,000	-36	-29	-17	-24	-26	-40	-47	26	22	15	19	20	7	0	20	20	16	20
30,000	-31	-26	-12	-20	-21	-35	-43	23	21	11	16	17	5	-1	20	20	13	20
20,000	-20	-16	-7	-12	-13	-23	-29	16	14	6	10	11	2	-2	15	15	9	14
MIAMI TO MONTREAL																		
53,000	11	4	-3	7	4	-4	-9	-17	-7	2	-9	-7	-17	-22	13	13	1221 N.MI.	13
40,000	13	10	-1	14	8	-5	-13	-25	-18	-2	-20	-16	-31	-39	21	21	17	21
30,000	12	6	2	12	7	-5	-12	-22	-12	-4	-17	-13	-26	-34	20	21	14	20
20,000	11	5	4	9	7	-2	-7	-15	-8	-5	-11	-9	-19	-25	16	16	9	15
MIAMI TO NEW ORLEANS																		
53,000	-39	-33	4	-16	-22	-38	-45	38	32	-4	15	21	3	-5	15	15	585 N.MI.	16
40,000	-56	-54	-3	-34	-38	-59	-69	52	51	2	32	35	13	3	23	23	17	21
30,000	-45	-42	-3	-25	-29	-47	-55	42	40	3	24	27	9	2	19	20	13	19
20,000	-26	-24	0	-11	-14	-27	-34	25	23	0	11	13	2	-3	15	15	8	13

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEAD WINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N								JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85						
MIAMI TO NEW YDRK													947 N.M.I.							
53,000	15	6	-3	8	5	-4	-9	-20	-10	3	-9	-8	-20	-26	14	15	9	14		
40,000	17	15	-1	16	11	-3	-11	-29	-23	-1	-22	-18	-35	-44	22	23	17	22		
30,000	16	10	2	14	9	-3	-10	-25	-16	-3	-18	-14	-29	-37	20	21	14	20		
20,000	13	8	5	11	8	0	-5	-17	-11	-6	-12	-11	-21	-27	16	16	9	15		
MIAMI TO PHILADELPHIA													882 N.M.I.							
53,000	12	4	-3	6	4	-5	-10	-18	-8	3	-8	-7	-18	-24	14	15	9	15		
40,000	14	12	-3	14	9	-6	-14	-25	-21	1	-19	-15	-32	-41	22	23	17	22		
30,000	12	7	0	12	7	-5	-12	-21	-13	-2	-16	-12	-26	-34	20	21	14	21		
20,000	11	6	4	9	7	-2	-7	-15	-9	-5	-11	-9	-19	-25	16	16	9	15		
MIAMI TO PITTSBURGH													881 N.M.I.							
53,000	-1	-4	-4	0	-3	-11	-16	-5	1	4	-2	0	-9	-14	14	15	9	15		
40,000	-6	-4	-8	2	-4	-19	-26	-7	-5	6	-8	-3	-18	-26	22	23	17	22		
30,000	-5	-7	-3	2	-3	-16	-23	-5	0	2	-6	-2	-15	-22	19	21	14	21		
20,000	0	-3	1	3	0	-9	-14	-5	0	-2	-5	-3	-12	-17	16	16	9	15		
MIAMI TO ST. LOUIS													929 N.M.I.							
53,000	-28	-23	-4	-13	-16	-28	-34	24	20	3	12	14	4	-1	14	14	9	14		
40,000	-40	-35	-13	-25	-27	-44	-52	29	28	11	21	22	7	0	22	23	17	21		
30,000	-33	-30	-9	-20	-22	-37	-46	25	25	8	17	18	5	-2	20	21	13	21		
20,000	-20	-18	-4	-10	-12	-23	-29	16	16	4	9	10	1	-4	16	16	9	15		
MIAMI TO SAN FRANCISCO													2242 N.M.I.							
53,000	-39	-31	-2	-19	-24	-35	-41	37	30	2	19	23	9	3	11	10	7	10		
40,000	-58	-50	-17	-38	-41	-57	-64	55	47	15	36	39	23	16	17	16	13	15		
30,000	-48	-41	-12	-30	-32	-47	-55	45	39	12	29	30	16	11	17	16	10	15		
20,000	-30	-25	-5	-15	-18	-29	-35	29	24	5	15	17	7	4	12	11	7	10		
MIAMI TO SAN JUAN													908 N.M.I.							
53,000	26	25	-6	7	12	-1	-6	-27	-25	6	-7	-12	-27	-34	14	14	8	12		
40,000	42	43	4	15	24	7	0	-44	-45	-4	-16	-26	-46	-54	18	19	13	19		
30,000	30	30	3	9	16	4	-1	-31	-31	-3	-10	-17	-32	-39	16	15	10	13		
20,000	10	13	-5	-1	3	-5	-8	-10	-14	5	1	-3	-13	-18	12	11	7	9		
MIAMI TO SEATTLE													2363 N.M.I.							
53,000	-34	-25	-7	-20	-21	-31	-36	32	23	6	19	20	11	6	10	9	7	9		
40,000	-51	-38	-22	-36	-37	-49	-56	46	35	20	33	33	21	15	16	15	13	16		
30,000	-44	-34	-18	-32	-31	-43	-51	39	31	17	29	28	17	11	17	16	11	16		
20,000	-29	-22	-11	-19	-19	-28	-34	27	20	11	18	18	10	7	12	12	7	11		
MIAMI TO TALLAHASSEE													350 N.M.I.							
53,000	-28	-26	0	-12	-15	-30	-37	24	24	-1	11	13	1	-5	16	16	10	17		
40,000	-40	-39	-6	-23	-26	-45	-55	32	33	5	20	22	5	-3	24	24	18	23		
30,000	-31	-33	-5	-18	-21	-36	-45	26	29	4	16	18	4	-3	20	21	14	20		
20,000	-19	-18	0	-6	-9	-21	-28	17	16	-1	6	8	-2	-6	16	16	9	14		
MIAMI TO WASHINGTON, D.C.													800 N.M.I.							
53,000	8	2	-4	4	2	-7	-12	-14	-5	4	-6	-4	-15	-21	15	15	9	15		
40,000	8	7	-5	10	5	-10	-18	-20	-16	3	-15	-11	-28	-37	23	24	17	23		
30,000	7	2	-1	9	4	-9	-15	-16	-9	0	-13	-9	-23	-30	20	21	14	21		
20,000	8	4	3	7	5	-4	-9	-12	-7	-4	-9	-7	-17	-22	17	16	9	15		
MILWAUKEE TO MINNEAPOLIS													257 N.M.I.							
53,000	-37	-23	-15	-25	-24	-36	-42	36	22	14	24	23	12	7	18	16	12	15		
40,000	-58	-38	-43	-44	-46	-64	-74	54	36	41	42	43	25	15	27	25	24	29		
30,000	-55	-37	-36	-40	-41	-61	-72	51	35	35	38	39	20	10	31	29	21	30		
20,000	-38	-25	-23	-28	-28	-42	-50	36	24	22	26	26	13	6	23	22	14	22		
MILWAUKEE TO NEW YORK													646 N.M.I.							
53,000	43	28	13	27	27	15	10	-44	-29	-13	-28	-27	-40	-48	17	15	11	14		
40,000	64	46	39	46	49	31	22	-72	-48	-40	-49	-51	-70	-81	26	25	22	26		
30,000	66	43	32	42	44	26	17	-69	-45	-34	-44	-46	-66	-78	27	27	19	27		
20,000	45	30	22	28	30	17	11	-46	-31	-23	-30	-31	-46	-54	21	21	13	20		
MILWAUKEE TO PHILADELPHIA													598 N.M.I.							
53,000	42	28	13	26	26	14	9	-43	-29	-13	-27	-27	-40	-47	17	15	11	14		
40,000	68	45	38	44	48	30	21	-71	-47	-39	-47	-50	-70	-80	26	25	22	26		
30,000	65	42	31	40	43	25	16	-68	-45	-32	-43	-45	-65	-77	27	28	19	27		
20,000	44	29	21	27	29	16	10	-46	-31	-22	-29	-30	-45	-54	21	21	13	21		

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MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*								STANDARD DEVIATION							
	O I R E C T				R E T U R N				JAN APR JUL OCT				JAN APR JUL OCT			
	JAN	APR	JUL	OCT	**A50	A75	A85		JAN	APR	JUL	OCT	A50	A75	A85	
MILWAUKEE TO WASHINGTON, D.C.																
53,000	39	27	12	24	24	13	8	-41	-28	-13	-25	-25	-38	-45		550 N.MI.
40,000	64	43	35	41	45	27	17	-69	-46	-37	-44	-48	-67	-78		17 16 12 15
30,000	61	40	28	36	40	22	13	-65	-43	-29	-40	-43	-63	-74		27 26 22 27
20,000	42	28	19	25	27	14	8	-44	-30	-20	-27	-29	-44	-52		27 28 19 28
MINNEAPOLIS TO NEW YORK																
53,000	40	26	14	26	25	15	10	-41	-27	-14	-27	-26	-37	-44		889 N.MI.
40,000	63	42	41	44	47	31	22	-66	-44	-42	-47	-49	-66	-76		15 13 10 13
30,000	60	40	34	40	42	26	18	-64	-42	-36	-43	-45	-63	-73		24 23 20 24
20,000	41	28	23	27	29	17	11	-43	-29	-24	-29	-30	-43	-50		26 25 18 25
MINNEAPOLIS TO OMAHA																
53,000	-19	-15	-8	-12	-13	-23	-29	16	13	7	10	11	1	-4		288 N.MI.
40,000	-36	-24	-23	-22	-26	-44	-53	27	20	18	16	20	3	-7		18 16 12 15
30,000	-32	-21	-18	-19	-22	-41	-51	24	16	15	14	17	-1	-11		28 25 23 29
20,000	-18	-13	-12	-12	-13	-26	-34	14	10	10	9	11	-2	-9		31 29 20 29
MINNEAPOLIS TO SALT LAKE CITY																
53,000	-32	-22	-15	-22	-22	-32	-37	30	22	15	21	21	13	8		859 N.MI.
40,000	-50	-35	-44	-40	-42	-58	-66	47	33	42	37	40	25	16		15 13 10 12
30,000	-45	-33	-36	-35	-37	-53	-62	42	31	34	32	35	19	10		23 21 20 24
20,000	-30	-21	-22	-24	-24	-35	-41	28	20	21	22	23	12	6		27 24 17 25
MINNEAPOLIS TO SEATTLE																
53,000	-31	-19	-15	-25	-22	-30	-35	30	19	15	24	21	13	9		1212 N.MI.
40,000	-45	-30	-37	-39	-38	-51	-59	44	28	36	37	36	23	16		13 11 9 10
30,000	-45	-30	-34	-38	-36	-51	-60	43	28	32	36	35	20	13		20 18 17 22
20,000	-31	-21	-22	-27	-25	-35	-41	30	20	21	26	24	14	9		23 22 17 23
MINNEAPOLIS TO SPOKANE																
53,000	-32	-19	-15	-25	-22	-31	-36	31	19	15	24	21	13	9		1022 N.MI.
40,000	-46	-30	-40	-39	-39	-53	-61	45	29	38	37	37	23	16		14 11 9 11
30,000	-46	-30	-35	-38	-37	-52	-61	44	28	33	36	35	20	12		20 19 19 23
20,000	-32	-21	-22	-27	-25	-36	-42	31	20	22	26	24	14	9		24 22 18 24
MINNEAPOLIS TO WASHINGTON, D.C.																
53,000	37	25	13	24	24	13	9	-39	-26	-13	-25	-25	-36	-43		807 N.MI.
40,000	60	40	38	41	44	28	19	-65	-43	-39	-44	-47	-64	-74		16 14 11 13
30,000	57	38	30	36	39	23	14	-61	-41	-32	-40	-42	-60	-70		24 23 21 25
20,000	40	27	20	25	27	15	9	-42	-28	-21	-27	-28	-42	-50		26 26 18 26
MINNEAPOLIS TO WINNIPEG																
53,000	-23	-11	-9	-17	-14	-24	-30	21	9	8	16	13	3	-2		342 N.MI.
40,000	-31	-18	-26	-27	-25	-42	-51	26	15	22	23	21	5	-4		16 13 11 14
30,000	-31	-20	-22	-26	-25	-42	-52	25	17	19	22	21	3	-6		24 22 22 28
20,000	-23	-16	-15	-19	-18	-31	-38	21	14	14	17	16	4	-3		28 27 21 28
MONCTON TO MONTREAL																
53,000	-41	-24	-16	-30	-26	-39	-46	40	23	15	29	26	14	9		376 N.MI.
40,000	-66	-43	-43	-55	-51	-71	-82	64	41	42	52	49	30	20		18 15 12 15
30,000	-62	-42	-42	-49	-48	-68	-81	59	39	40	47	45	26	15		29 27 25 29
20,000	-42	-27	-27	-34	-32	-47	-55	40	26	26	32	31	17	9		35 31 23 29
MONCTON TO TORONTO																
53,000	-41	-24	-15	-29	-26	-38	-45	40	24	14	29	26	15	9		651 N.MI.
40,000	-68	-43	-42	-53	-51	-70	-80	65	41	40	51	49	31	21		17 14 12 14
30,000	-65	-41	-39	-48	-47	-67	-78	61	38	38	46	45	26	17		27 25 23 26
20,000	-43	-27	-26	-33	-31	-45	-53	41	26	25	31	30	17	10		32 29 21 27
MONTREAL TO NEW YORK																
53,000	-7	0	3	-5	-2	-13	-19	2	-2	-4	3	-1	-11	-17		290 N.MI.
40,000	-12	-4	0	-11	-6	-26	-36	-2	-3	-5	3	-2	-21	-31		18 16 13 15
30,000	-11	-2	-1	-10	-6	-26	-37	-2	-5	-3	3	-2	-21	-32		30 28 25 29
20,000	-8	0	0	-6	-3	-17	-26	2	-4	-2	3	0	-14	-22		34 32 22 30
MONTREAL TO SAGUENAY																
53,000	23	11	6	17	14	3	-3	-26	-12	-7	-19	-15	-27	-33		214 N.MI.
40,000	35	17	16	29	24	5	-5	-42	-21	-21	-35	-29	-49	-59		18 15 13 15
30,000	32	16	15	26	22	2	-9	-40	-21	-20	-31	-27	-48	-60		29 27 26 29
20,000	23	11	11	17	15	1	-7	-26	-13	-13	-20	-17	-32	-41		34 32 24 30

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION							
	D I R E C T							R E T U R N							JAN	APR	JUL	OCT				
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT				
MONTREAL TO ST. JOHN																			331 N.MI.			
53,000	40	24	16	29	26	15	9	-41	-24	-16	-30	-27	-39	-46	18	16	13	15				
40,000	64	42	42	52	50	30	20	-67	-44	-44	-54	-52	-72	-83	30	27	26	29				
30,000	60	40	41	46	46	26	15	-63	-43	-42	-48	-48	-69	-81	36	32	23	30				
20,000	40	27	26	32	31	17	9	-42	-28	-27	-33	-32	-47	-55	24	23	15	23				
MONTREAL TO TAMPA																			1130 N.MI.			
53,000	-23	-12	1	-12	-11	-22	-28	18	9	-2	10	8	-1	-6	14	13	9	13				
40,000	-34	-24	-5	-26	-22	-38	-47	22	16	2	20	15	0	-8	22	22	17	22				
30,000	-31	-18	-7	-22	-18	-34	-42	21	12	5	17	13	0	-7	21	22	14	21				
20,000	-22	-12	-6	-14	-12	-24	-30	17	9	5	12	10	0	-5	17	17	9	16				
MONTREAL TO TORONTO																			273 N.MI.			
53,000	-40	-24	-13	-28	-25	-38	-45	38	23	12	27	24	12	7	18	16	13	15				
40,000	-65	-42	-38	-49	-48	-68	-79	62	39	36	46	45	26	16	29	28	25	29				
30,000	-64	-38	-35	-45	-44	-66	-78	60	35	33	42	41	21	11	33	31	23	30				
20,000	-42	-25	-23	-30	-29	-45	-54	40	23	22	29	28	13	6	24	23	15	23				
MONTREAL TO VANCOUVER																			1986 N.MI.			
53,000	-31	-18	-16	-25	-22	-29	-33	30	18	15	24	21	14	11	11	8	7	9				
40,000	-44	-28	-36	-38	-37	-48	-54	42	27	34	36	35	24	18	15	15	15	17				
30,000	-46	-30	-34	-38	-36	-49	-56	43	28	32	36	35	23	16	18	18	14	18				
20,000	-32	-20	-23	-26	-25	-34	-38	30	19	22	25	24	16	11	13	13	10	13				
MONTREAL TO WASHINGTON, D.C.																			423 N.MI.			
53,000	-22	-10	-2	-15	-11	-23	-30	18	8	1	13	9	-2	-7	18	16	12	15				
40,000	-34	-20	-12	-28	-23	-42	-53	21	13	8	21	15	-3	-13	29	27	24	28				
30,000	-32	-18	-13	-25	-21	-40	-51	21	11	9	19	14	-4	-14	31	30	21	29				
20,000	-23	-10	-8	-16	-13	-28	-36	17	6	7	13	10	-3	-10	23	22	14	22				
NASHVILLE TO NEW YORK																			663 N.MI.			
53,000	47	30	6	26	26	12	5	-48	-31	-6	-27	-27	-43	-51	16	16	11	14				
40,000	70	47	24	48	46	27	17	-74	-50	-27	-51	-49	-70	-82	26	26	21	26				
30,000	64	43	22	41	41	22	14	-68	-46	-23	-44	-43	-65	-77	25	27	17	26				
20,000	45	28	16	27	27	14	8	-47	-30	-17	-28	-28	-44	-53	20	20	11	19				
NASHVILLE TO ST. LOUIS																			235 N.MI.			
53,000	-38	-27	-9	-20	-22	-36	-44	35	25	8	19	20	8	3	19	17	12	16				
40,000	-58	-42	-25	-38	-40	-61	-72	49	38	23	34	35	16	6	29	28	23	28				
30,000	-51	-37	-18	-32	-33	-54	-65	44	33	17	28	29	11	1	29	29	18	30				
20,000	-33	-25	-12	-21	-21	-36	-45	29	23	11	19	19	7	0	22	22	12	21				
NASHVILLE TO TULSA																			445 N.MI.			
53,000	-50	-36	-6	-26	-29	-45	-53	49	36	5	26	28	12	5	18	16	11	15				
40,000	-78	-56	-23	-50	-50	-73	-86	75	54	22	48	49	27	17	28	27	21	26				
30,000	-67	-48	-16	-40	-41	-65	-77	65	46	15	38	39	18	9	28	27	17	28				
20,000	-44	-32	-12	-24	-26	-43	-52	43	31	11	23	25	11	5	21	20	11	19				
NASHVILLE TO WASHINGTON, D.C.																			487 N.MI.			
53,000	49	32	5	26	27	11	4	-50	-33	-5	-27	-28	-45	-52	17	16	11	15				
40,000	73	50	22	49	48	26	16	-76	-53	-24	-51	-50	-72	-85	27	27	21	27				
30,000	66	44	19	41	41	21	12	-69	-47	-20	-44	-43	-66	-78	25	27	17	27				
20,000	46	30	15	26	27	13	7	-47	-31	-15	-27	-28	-45	-54	21	21	12	20				
NEW ORLEANS TO NEW YORK																			1025 N.MI.			
53,000	41	26	-1	20	22	6	0	-44	-28	0	-22	-23	-38	-45	14	14	9	13				
40,000	59	42	11	40	38	18	9	-66	-47	-13	-44	-42	-62	-73	22	23	18	22				
30,000	53	36	11	33	32	15	7	-59	-40	-12	-36	-35	-56	-66	21	23	14	22				
20,000	38	24	8	20	20	9	4	-40	-26	-9	-22	-22	-37	-45	17	17	9	16				
NEW ORLEANS TO ST. PETERSBURG																			416 N.MI.			
53,000	43	35	-5	17	24	3	-5	-44	-36	5	-18	-25	-42	-49	16	16	10	16				
40,000	60	56	3	37	40	16	5	-63	-58	-4	-39	-42	-64	-75	24	25	18	22				
30,000	49	44	3	28	31	11	2	-51	-45	-4	-30	-32	-52	-62	21	22	14	21				
20,000	30	26	1	14	16	4	-1	-31	-27	-2	-14	-17	-31	-39	17	16	9	15				
NEW ORLEANS TO SHREVEPORT																			235 N.MI.			
53,000	-36	-30	0	-17	-20	-35	-43	32	28	0	16	18	4	-2	17	17	11	16				
40,000	-53	-49	-9	-37	-36	-58	-69	44	43	8	34	32	12	2	28	27	21	23				
30,000	-44	-38	-7	-28	-28	-48	-59	38	35	6	26	24	7	-1	26	26	16	25				
20,000	-27	-24	-2	-15	-15	-30	-38	24	22	2	14	14	2	-4	19	18	10	17				

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HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	O I R E C T							R E T U R N							JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85				
NEW ORLEANS TO TAMPA																		
53,000	43	35	-5	18	24	3	-5	-44	-36	5	-18	-25	-42	-49	16	16	10	16
40,000	60	56	3	38	40	16	5	-63	-59	-4	-39	-42	-65	-76	24	25	18	22
30,000	49	44	3	29	31	11	2	-52	-45	-4	-30	-32	-53	-62	21	22	14	21
20,000	30	26	1	14	16	4	-1	-31	-27	-2	-14	-17	-31	-39	17	16	9	15
NEWPORT NEWS TO NEW YORK																		
53,000	27	13	0	17	13	1	-5	-31	-16	-1	-19	-16	-30	-38	19	18	12	16
40,000	33	24	11	31	24	5	-5	-45	-31	-15	-37	-31	-52	-63	30	29	24	29
30,000	32	22	13	27	22	4	-5	-42	-29	-15	-32	-28	-48	-60	30	30	20	29
20,000	27	14	10	19	16	3	-4	-32	-17	-11	-21	-19	-34	-43	23	23	13	22
NEW YORK TO NORFOLK																		
53,000	-28	-14	0	-17	-14	-27	-35	23	11	-1	15	11	-1	-7	19	18	12	16
40,000	-40	-28	-12	-34	-28	-48	-59	28	20	9	28	21	1	-9	30	29	24	29
30,000	-38	-25	-13	-29	-25	-45	-56	26	19	11	24	19	1	-9	30	30	19	29
20,000	-29	-15	-10	-19	-17	-32	-40	23	12	9	17	14	1	-6	23	23	13	22
NEW YORK TO PHOENIX																		
53,000	-43	-32	-9	-25	-27	-39	-45	42	31	9	25	27	15	9	12	11	8	10
40,000	-71	-50	-32	-46	-48	-65	-74	68	48	30	43	46	32	25	19	18	15	18
30,000	-62	-45	-24	-39	-40	-57	-67	60	42	23	36	38	24	18	20	19	12	18
20,000	-41	-29	-17	-24	-26	-38	-44	39	28	16	23	25	15	11	15	14	8	13
NEW YORK TO PITTSBURGH																		
53,000	-49	-31	-12	-30	-29	-44	-53	48	31	11	29	29	15	9	19	17	12	16
40,000	-77	-52	-38	-53	-54	-75	-87	75	50	36	51	52	32	21	29	29	24	29
30,000	-74	-49	-32	-47	-48	-71	-84	72	46	31	45	47	27	17	30	30	20	30
20,000	-51	-33	-22	-31	-33	-49	-59	49	32	22	30	31	17	10	23	23	13	22
NEW YORK TO PORTLAND, ME.																		
53,000	31	16	5	22	18	6	-1	-35	-18	-6	-23	-19	-33	-41	19	17	12	16
40,000	46	29	22	38	33	13	3	-54	-34	-26	-43	-39	-60	-71	30	29	26	30
30,000	44	27	22	33	30	10	0	-52	-32	-25	-37	-35	-57	-69	35	32	22	30
20,000	33	19	15	23	21	7	0	-37	-22	-16	-25	-24	-40	-48	24	24	14	23
NEW YORK TO RALEIGH																		
53,000	-37	-21	-2	-21	-19	-34	-42	33	19	1	20	17	4	-2	18	17	12	16
40,000	-53	-37	-17	-41	-36	-57	-68	43	31	14	37	31	11	1	28	28	23	28
30,000	-50	-34	-16	-36	-32	-53	-64	41	29	14	32	27	10	1	28	29	18	28
20,000	-36	-21	-12	-23	-22	-37	-46	32	18	11	21	19	7	0	22	22	12	21
NEW YORK TO RICHMOND																		
53,000	-38	-21	-3	-23	-20	-35	-43	34	19	2	21	18	5	-1	19	18	12	16
40,000	-55	-38	-20	-43	-38	-60	-71	45	32	17	38	32	13	2	30	29	24	29
30,000	-52	-35	-19	-37	-34	-56	-67	43	30	17	33	29	11	1	30	30	20	30
20,000	-38	-22	-14	-24	-23	-39	-48	34	19	13	22	21	7	0	23	23	13	22
NEW YORK TO ROCHESTER, N.Y.																		
53,000	-34	-24	-12	-20	-22	-34	-41	31	22	12	19	20	9	3	19	17	13	16
40,000	-58	-39	-33	-37	-41	-62	-73	50	35	31	32	36	17	7	30	29	25	29
30,000	-56	-38	-28	-33	-37	-59	-70	48	34	26	28	33	14	3	32	31	22	30
20,000	-36	-27	-19	-22	-25	-40	-49	32	25	18	19	23	9	2	24	24	14	23
NEW YORK TO ST. LOUIS																		
53,000	-49	-32	-10	-29	-29	-43	-51	48	31	10	28	28	15	9	16	15	11	14
40,000	-77	-52	-35	-52	-53	-73	-84	75	50	33	50	50	32	23	26	25	21	25
30,000	-72	-48	-29	-46	-46	-67	-80	70	45	27	44	44	27	18	25	26	17	26
20,000	-49	-32	-20	-30	-31	-46	-55	48	30	20	29	30	17	11	20	20	12	19
NEW YORK TO SAN FRANCISCO																		
53,000	-38	-27	-13	-25	-25	-34	-39	37	26	13	24	24	16	12	11	10	7	9
40,000	-61	-42	-40	-44	-46	-59	-66	59	40	38	41	44	32	26	17	16	14	17
30,000	-55	-39	-31	-38	-39	-53	-61	52	37	30	35	37	26	20	19	18	12	18
20,000	-36	-25	-20	-25	-26	-35	-41	35	24	20	23	25	16	12	14	13	8	13
NEW YORK TO SEATTLE																		
53,000	-34	-22	-15	-25	-23	-31	-36	33	21	15	25	22	15	12	11	9	7	9
40,000	-52	-35	-39	-41	-41	-53	-60	50	33	37	39	39	28	22	16	15	15	18
30,000	-52	-34	-34	-39	-39	-52	-59	49	32	33	37	37	25	19	19	18	14	18
20,000	-35	-24	-22	-27	-27	-36	-41	34	22	22	26	25	17	13	14	13	9	13

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HEIGHT IN FEET	EQUIVALENT							HEADWINDS*							STANDARD DEVIATION			
	D I R E C T							R E T U R N										
	JAN	APR	JUL	OCT	•A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT
NEW YORK TO TAMPA																		
53,000	-29	-16	2	-14	-13	-27	-33	24	13	-3	12	11	0	-5	15	15	874 N.MI. 10	14
40,000	-41	-32	-5	-30	-26	-45	-54	31	24	3	25	20	4	-5	23	24	18	23
30,000	-36	-24	-6	-25	-22	-38	-47	28	19	5	21	17	3	-4	21	23	14	22
20,000	-26	-17	-7	-16	-15	-27	-34	22	14	6	14	13	3	-2	17	17	9	16
NEW YORK TO TOLEDO																		
53,000	-47	-31	-13	-29	-29	-43	-50	46	30	12	28	28	15	9	18	16	456 N.MI. 12	15
40,000	-75	-50	-39	-51	-53	-73	-85	73	48	37	48	51	31	22	28	27	23	27
30,000	-72	-47	-33	-46	-48	-69	-81	70	45	32	43	46	26	17	28	29	20	28
20,000	-49	-33	-23	-30	-32	-48	-57	47	31	22	29	31	17	11	22	22	13	21
NEW YORK TO TORONTO																		
53,000	-37	-25	-13	-23	-23	-36	-43	34	24	12	21	22	11	5	18	16	318 N.MI. 13	15
40,000	-61	-41	-36	-41	-44	-64	-75	55	38	33	36	40	21	11	29	28	24	28
30,000	-59	-40	-30	-36	-40	-61	-73	53	36	28	32	36	17	7	31	31	21	30
20,000	-39	-28	-21	-24	-27	-42	-50	35	26	20	22	25	11	4	23	23	14	22
NEW YORK TO TUCSON																		
53,000	-44	-33	-8	-25	-28	-39	-45	43	32	7	24	27	14	8	12	11	1852 N.MI. 8	10
40,000	-71	-52	-28	-46	-48	-65	-75	69	49	27	44	46	31	23	19	18	15	18
30,000	-63	-46	-22	-38	-40	-58	-67	60	43	21	36	38	23	17	20	19	12	18
20,000	-41	-29	-15	-23	-25	-38	-44	40	28	15	22	24	15	10	15	14	8	13
NEW YORK TO WEST PALM BEACH																		
53,000	-21	-10	3	-10	-9	-20	-27	15	7	-3	8	6	-4	-9	15	15	894 N.MI. 9	15
40,000	-30	-24	-1	-23	-19	-36	-45	18	16	0	17	12	-3	-11	23	23	17	23
30,000	-26	-17	-3	-19	-15	-30	-39	17	10	2	15	10	-3	-10	21	22	14	21
20,000	-18	-12	-6	-13	-11	-22	-28	14	9	5	11	9	0	-5	17	17	9	15
NEW YORK TO YOUNGSTOWN																		
53,000	-47	-31	-13	-29	-29	-43	-51	46	30	12	28	28	15	9	18	17	315 N.MI. 12	16
40,000	-76	-51	-39	-51	-53	-74	-86	74	49	37	49	51	31	21	29	28	24	28
30,000	-73	-48	-33	-46	-48	-70	-83	70	46	32	43	46	26	16	30	30	20	30
20,000	-50	-33	-23	-31	-32	-49	-58	48	32	22	29	31	17	10	23	23	14	22
OAKLAND TO PHOENIX																		
53,000	31	23	3	17	18	6	1	-32	-24	-4	-18	-19	-31	-38	17	15	560 N.MI. 11	13
40,000	46	38	18	30	32	15	6	-49	-41	-21	-32	-35	-53	-63	27	25	21	24
30,000	39	34	13	24	26	9	1	-42	-36	-15	-26	-28	-47	-57	30	26	19	23
20,000	25	20	7	12	15	3	-3	-27	-21	-8	-13	-16	-29	-37	21	19	12	17
OAKLAND TO SALT LAKE CITY																		
53,000	27	22	14	19	20	10	5	-29	-23	-14	-20	-20	-31	-37	17	14	510 N.MI. 11	13
40,000	39	31	35	33	35	17	8	-43	-33	-37	-35	-37	-54	-63	27	25	22	26
30,000	35	28	26	25	28	11	2	-39	-31	-27	-28	-31	-49	-58	30	27	20	26
20,000	22	18	16	15	18	6	-1	-24	-19	-17	-16	-19	-31	-38	22	20	13	19
OKLAHOMA CITY TO ST. LOUIS																		
53,000	39	30	5	21	23	9	3	-41	-31	-6	-22	-24	-39	-47	18	16	401 N.MI. 12	15
40,000	66	45	20	39	41	21	11	-70	-48	-22	-42	-44	-66	-79	29	27	22	27
30,000	56	39	14	30	32	13	4	-60	-42	-15	-33	-35	-58	-70	29	27	17	28
20,000	36	25	11	19	21	8	2	-38	-27	-11	-20	-22	-37	-46	22	20	12	19
ONTARIO TO SAN FRANCISCO																		
53,000	-28	-20	-2	-15	-15	-28	-35	27	19	2	14	14	3	-3	18	16	316 N.MI. 12	14
40,000	-42	-35	-14	-26	-28	-48	-58	38	32	10	23	25	7	-3	28	26	22	26
30,000	-36	-32	-11	-21	-24	-43	-53	32	29	9	19	21	3	-6	31	28	21	25
20,000	-24	-17	-6	-11	-13	-27	-35	22	16	6	10	12	0	-6	23	20	13	18
PANAMA CITY TO TAMPA																		
53,000	33	30	-2	14	18	3	-4	-36	-31	2	-15	-20	-36	-44	16	17	213 N.MI. 11	18
40,000	45	44	5	29	30	10	0	-51	-49	-6	-32	-34	-55	-66	26	26	19	24
30,000	37	37	4	23	24	7	-1	-41	-39	-5	-25	-27	-45	-55	22	23	15	22
20,000	23	21	3	10	13	2	-3	-25	-23	-3	-11	-13	-27	-35	18	17	9	15
PHILADELPHIA TO PITTSBURGH																		
53,000	-48	-32	-12	-29	-29	-44	-52	47	31	12	28	28	15	8	19	17	231 N.MI. 13	16
40,000	-78	-52	-38	-51	-53	-75	-87	75	50	36	48	51	31	20	30	29	24	29
30,000	-74	-49	-31	-45	-48	-71	-84	72	46	30	43	46	26	16	29	31	20	30
20,000	-51	-34	-22	-30	-32	-49	-59	49	33	21	29	31	17	10	24	23	13	23

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

•A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N								JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85		JAN	APR	JUL	OCT	A50	A75	A85		JAN	APR	JUL	OCT
PHILADELPHIA TO ROCHESTER, N.Y.																				
53,000	-22	-17	-10	-12	-14	-26	-32		17	15	9	10	12	1	-4		19	17	13	16
40,000	-41	-27	-24	-23	-28	-48	-59		29	21	21	15	22	2	-8		30	29	25	29
30,000	-39	-27	-19	-20	-25	-46	-57		28	21	16	14	19	0	-10		31	31	21	30
20,000	-24	-20	-13	-13	-17	-31	-40		18	17	11	10	14	0	-7		24	24	14	23
PHILADELPHIA TO ST. LOUIS																				
53,000	-49	-33	-10	-29	-29	-44	-52		48	32	10	28	29	15	9		16	15	11	14
40,000	-78	-53	-34	-52	-53	-73	-85		76	51	32	49	51	32	23		26	25	21	26
30,000	-73	-48	-27	-46	-46	-68	-80		70	46	26	43	44	26	17		26	26	17	26
20,000	-50	-32	-20	-30	-31	-47	-56		48	31	19	29	30	17	11		20	20	12	20
PHILADELPHIA TO SAN JUAN																				
53,000	16	16	3	7	9	1	-3		-20	-18	-3	-8	-11	-21	-27		13	13	8	12
40,000	22	17	6	9	13	1	-5		-30	-24	-8	-13	-18	-31	-39		19	20	13	18
30,000	20	16	5	6	11	0	-5		-25	-21	-5	-9	-14	-26	-34		18	17	11	16
20,000	11	9	-1	-2	3	-4	-8		-13	-11	0	1	-5	-14	-19		13	13	7	11
PHILADELPHIA TO YOUNGSTOWN																				
53,000	-45	-30	-13	-27	-27	-42	-50		43	29	12	26	26	14	8		19	17	13	16
40,000	-74	-50	-38	-48	-51	-73	-84		71	47	36	44	49	28	18		29	29	24	29
30,000	-71	-47	-31	-43	-46	-68	-81		68	44	30	40	43	24	14		29	30	20	30
20,000	-48	-33	-21	-28	-31	-47	-57		46	32	21	27	30	15	8		24	23	14	23
PHOENIX TO SAN DIEGO																				
53,000	-35	-31	-5	-20	-22	-36	-43		34	31	4	19	21	8	1		19	16	12	15
40,000	-53	-48	-27	-35	-40	-59	-69		51	46	25	34	38	20	11		28	26	21	25
30,000	-46	-41	-17	-28	-31	-50	-61		43	39	16	26	29	12	4		31	26	18	22
20,000	-28	-24	-9	-13	-17	-30	-39		27	24	9	12	16	5	-1		22	19	11	17
PHOENIX TO SAN FRANCISCO																				
53,000	-32	-25	-4	-18	-19	-32	-38		31	24	4	17	18	6	1		17	14	11	13
40,000	-49	-41	-21	-32	-35	-53	-63		46	38	19	30	32	15	6		27	25	20	24
30,000	-42	-37	-15	-26	-28	-47	-57		39	34	14	24	26	10	1		29	26	19	23
20,000	-27	-21	-8	-13	-16	-29	-37		25	20	8	12	15	3	-2		21	19	12	17
PITTSBURGH TO RALEIGH																				
53,000	4	7	7	2	5	-6	-12		-10	-10	-7	-5	-8	-19	-24		18	17	12	16
40,000	11	9	12	-1	8	-10	-21		-26	-17	-15	-7	-16	-35	-45		28	29	23	28
30,000	11	8	6	0	6	-11	-20		-24	-15	-8	-6	-13	-31	-40		26	29	18	29
20,000	5	10	4	0	4	-8	-15		-12	-13	-5	-3	-8	-21	-29		22	22	13	21
PITTSBURGH TO ST. PETERSBURG																				
53,000	-14	-6	4	-6	-5	-15	-21		8	2	-4	4	2	-8	-12		15	15	10	15
40,000	-20	-14	3	-16	-11	-28	-37		7	5	-5	9	3	-12	-20		23	24	18	23
30,000	-17	-9	0	-13	-9	-24	-32		7	2	-1	8	3	-10	-17		21	23	15	23
20,000	-13	-5	-2	-8	-6	-17	-23		8	2	2	6	4	-6	-11		18	18	10	16
PORTLAND, ORE. TO RENO																				
53,000	16	6	-2	6	6	-4	-9		-18	-8	1	-8	-7	-18	-24		17	15	11	13
40,000	19	14	1	12	11	-7	-16		-25	-18	-5	-17	-16	-34	-44		28	26	23	28
30,000	18	13	1	13	11	-8	-18		-24	-18	-4	-17	-15	-35	-46		31	29	23	29
20,000	12	7	2	5	6	-7	-14		-15	-9	-3	-7	-8	-22	-30		24	21	14	21
PORTLAND, ORE. TO SALT LAKE CITY																				
53,000	29	17	8	20	18	8	3		-30	-18	-9	-21	-18	-29	-36		16	14	11	13
40,000	41	28	22	32	30	13	4		-43	-30	-24	-35	-33	-51	-60		26	24	22	27
30,000	34	27	19	30	28	10	0		-42	-30	-22	-32	-31	-50	-60		30	28	21	28
20,000	26	17	13	18	18	6	-1		-27	-18	-14	-20	-19	-32	-40		21	20	13	19
PORTLAND, ORE. TO SAN FRANCISCO																				
53,000	7	0	-6	0	-1	-10	-15		-10	-1	5	-1	-1	-11	-17		17	14	11	14
40,000	6	4	-8	0	0	-17	-26		-12	-9	4	-5	-5	-23	-33		27	25	22	27
30,000	5	4	-5	2	1	-17	-27		-12	-8	3	-7	-5	-24	-35		31	28	22	28
20,000	4	1	-2	-1	0	-13	-19		-7	-3	0	-1	-2	-15	-23		23	21	14	20
PORTLAND, ORE. TO SPOKANE																				
53,000	18	15	14	20	17	7	2		-19	-16	-14	-21	-17	-27	-33		17	15	12	13
40,000	28	21	22	27	24	7	-3		-32	-23	-23	-31	-27	-45	-55		27	26	24	29
30,000	30	22	24	26	25	6	-5		-34	-25	-25	-30	-28	-48	-59		31	31	24	31
20,000	20	16	16	20	18	4	-3		-22	-17	-17	-22	-19	-33	-41		23	22	16	22

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

THE BOEING COMPANY
TRANSPORT DIVISION

NO. D6-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*												STANDARD DEVIATION						
	D I R E C T							R E T U R N											
	JAN	APR	JUL	DCT	**A50	A75	A85	JAN	APR	JUL	DCT	A50	A75	A85	JAN	APR	JUL	OCT	
PRINCE GEORGE TO VANCOUVER																			283 N.MI.
53,000	6	-1	-3	-2	0	-10	-14	-9	0	2	1	-1	-11	-16	17	14	12	13	
40,000	6	-1	-1	-2	1	-15	-24	-11	-2	-1	-3	-4	-20	-29	24	23	23	25	
30,000	3	-4	-2	-7	-3	-21	-32	-8	1	-1	2	-2	-20	-31	28	29	25	29	
20,000	0	-4	-1	-5	-2	-16	-23	-3	2	0	2	0	-13	-20	22	21	16	20	
PRINCE RUPERT TO VANCOUVER																			408 N.MI.
53,000	23	10	6	14	13	3	-2	-24	-11	-6	-15	-13	-24	-29	16	14	11	12	
40,000	30	17	16	23	21	5	-4	-32	-19	-17	-26	-24	-40	-49	24	22	23	23	
30,000	28	15	15	17	19	0	-10	-31	-18	-17	-21	-22	-41	-51	28	29	25	29	
20,000	17	7	10	12	12	-2	-9	-19	-9	-11	-15	-13	-27	-35	23	21	16	20	
PROVIDENCE TO WASHINGTON, D.C.																			309 N.MI.
53,000	-44	-25	-7	-28	-25	-40	-48	42	24	7	27	23	10	4	19	17	12	16	
40,000	-65	-45	-30	-50	-47	-68	-79	59	41	27	47	43	23	12	30	29	24	29	
30,000	-63	-42	-27	-43	-42	-64	-76	57	38	25	40	38	19	9	31	31	20	30	
20,000	-45	-28	-19	-29	-28	-45	-54	42	26	18	27	27	13	6	23	23	13	22	
QUEBEC TO SEVEN ISLANDS																			285 N.MI.
53,000	29	14	10	23	18	7	2	-31	-15	-11	-24	-19	-31	-38	18	15	13	15	
40,000	44	22	24	39	32	13	3	-48	-24	-28	-43	-35	-55	-65	28	25	25	28	
30,000	40	22	22	36	29	10	-1	-44	-26	-26	-40	-33	-54	-65	32	31	24	30	
20,000	28	14	16	21	19	5	-2	-30	-16	-17	-24	-21	-36	-44	23	23	16	22	
REGINA TO WINNIPEG																			287 N.MI.
53,000	29	17	16	23	20	12	7	-30	-17	-16	-24	-21	-31	-36	16	12	11	13	
40,000	41	24	38	34	34	18	9	-42	-25	-39	-36	-35	-52	-60	22	21	22	28	
30,000	42	25	33	33	33	16	6	-43	-27	-34	-35	-35	-52	-62	26	26	22	28	
20,000	29	19	22	25	23	12	6	-30	-20	-23	-26	-24	-36	-43	19	17	15	19	
RENO TO SALT LAKE CITY																			366 N.MI.
53,000	30	23	14	21	21	11	6	-31	-23	-14	-21	-21	-32	-38	17	15	11	14	
40,000	43	33	36	35	37	19	9	-46	-35	-37	-37	-39	-57	-66	28	26	23	28	
30,000	39	30	27	28	30	12	3	-42	-33	-28	-30	-33	-52	-62	32	29	21	28	
20,000	25	19	17	17	19	7	0	-26	-20	-18	-18	-20	-33	-40	23	21	13	20	
RENO TO SEATTLE																			490 N.MI.
53,000	-16	-5	2	-6	-5	-16	-22	14	4	-3	4	4	-5	-10	17	14	11	13	
40,000	-21	-14	-2	-14	-12	-30	-40	15	11	-1	9	8	-9	-18	27	25	23	28	
30,000	-20	-14	-2	-14	-12	-31	-42	14	10	-1	10	8	-11	-21	30	28	22	29	
20,000	-12	-6	-2	-6	-6	-19	-27	9	4	0	3	4	-9	-16	23	21	14	20	
ROCHESTER, N.Y. TO WASHINGTON, D.C.																			258 N.MI.
53,000	-3	3	5	-2	1	-10	-16	-3	-6	-6	0	-4	-14	-20	19	17	13	16	
40,000	0	2	7	-6	1	-18	-28	-15	-9	-11	-2	-9	-28	-39	30	29	24	29	
30,000	1	3	3	-5	1	-18	-28	-14	-10	-6	-2	-8	-27	-37	30	31	21	30	
20,000	0	6	2	-3	1	-12	-20	-7	-9	-4	-1	-5	-19	-27	24	23	14	23	
SAGUENAY TO SEVEN ISLANDS																			207 N.MI.
53,000	33	16	14	27	22	10	4	-34	-17	-14	-28	-22	-35	-41	18	15	13	16	
40,000	49	25	31	46	37	18	8	-51	-27	-34	-48	-40	-59	-70	28	25	25	28	
30,000	44	26	30	42	35	15	4	-47	-29	-32	-45	-38	-59	-70	32	31	24	30	
20,000	31	16	21	25	23	9	1	-33	-17	-22	-27	-24	-39	-47	23	23	16	22	
ST. JOHNS TO SYDNEY																			312 N.MI.
53,000	-37	-21	-17	-29	-25	-38	-45	36	20	16	28	24	12	6	21	16	13	17	
40,000	-54	-39	-44	-57	-49	-69	-80	55	37	42	55	47	27	17	30	28	26	30	
30,000	-57	-38	-41	-53	-47	-68	-80	54	36	39	50	44	24	13	34	31	25	30	
20,000	-40	-25	-26	-34	-31	-46	-55	38	23	25	33	29	14	6	26	24	17	23	
ST. LOUIS TO SAN FRANCISCO																			1504 N.MI.
53,000	-37	-28	-11	-23	-24	-35	-40	36	28	11	23	24	14	10	13	11	8	11	
40,000	-60	-42	-36	-42	-44	-59	-67	58	40	35	39	42	29	22	21	19	16	20	
30,000	-51	-38	-27	-35	-36	-51	-59	48	36	26	32	34	21	15	23	20	14	20	
20,000	-33	-24	-17	-21	-23	-33	-39	31	23	16	20	22	13	8	16	15	9	14	
ST. LOUIS TO TAMPA																			756 N.MI.
53,000	22	19	4	11	13	3	-2	-27	-22	-5	-13	-16	-27	-34	15	15	10	14	
40,000	26	26	12	20	21	6	-2	-38	-33	-14	-26	-27	-44	-53	24	24	18	23	
30,000	23	23	8	16	17	3	-4	-32	-29	-9	-20	-21	-37	-47	22	23	14	23	
20,000	15	15	5	9	10	1	-4	-19	-17	-6	-11	-12	-24	-30	18	17	9	16	

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EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT								HEADWINDS*								STANDARD DEVIATION			
	D I R E C T								R E T U R N								JAN	APR	JUL	OCT
	JAN	APR	JUL	OCT	**A50	A75	A85		JAN	APR	JUL	OCT	A50	A75	A85		JAN	APR	JUL	OCT
ST. LOUIS TO TULSA																				
53,000	-42	-31	-6	-23	-24	-39	-47		39	29	5	22	23	9	3		18	17	12	15
40,000	-70	-48	-22	-42	-44	-66	-79		66	44	20	39	41	20	10		29	27	23	27
30,000	-60	-41	-16	-34	-35	-58	-71		56	38	15	31	32	13	4		30	28	18	29
20,000	-38	-27	-12	-21	-22	-38	-47		36	25	11	19	21	8	2		22	21	12	20
ST. LOUIS TO WASHINGTON, D.C.																				
53,000	49	33	9	28	29	15	8		-50	-34	-10	-28	-29	-44	-52		17	16	11	14
40,000	76	52	31	49	51	31	22		-78	-54	-32	-51	-53	-74	-85		26	26	21	26
30,000	70	46	25	42	44	25	16		-72	-48	-26	-45	-46	-68	-80		26	27	17	27
20,000	48	31	18	28	29	16	10		-49	-32	-19	-29	-30	-46	-55		21	20	12	20
ST. PETERSBURG TO WASHINGTON, D.C.																				
53,000	19	10	-4	9	8	-3	-8		-24	-14	3	-11	-10	-23	-30		15	16	10	15
40,000	24	19	-1	20	14	-2	-10		-35	-27	-1	-25	-22	-40	-50		23	25	18	24
30,000	21	13	2	17	12	-2	-9		-30	-19	-3	-21	-17	-33	-43		21	23	15	22
20,000	18	10	4	11	10	0	-5		-22	-13	-5	-13	-12	-24	-31		18	17	9	16
SALT LAKE CITY TO SAN FRANCISCO																				
53,000	-29	-23	-14	-20	-20	-31	-37		27	22	14	19	20	10	5		17	14	11	13
40,000	-43	-33	-37	-35	-37	-54	-63		39	31	35	32	34	17	8		27	25	22	26
30,000	-39	-31	-27	-28	-31	-48	-58		35	28	26	25	28	11	2		30	27	20	26
20,000	-24	-19	-17	-16	-19	-31	-38		22	18	16	15	18	6	-1		22	20	13	19
SAN DIEGO TO SAN FRANCISCO																				
53,000	-26	-18	0	-13	-13	-25	-33		24	16	0	12	12	1	-5		18	15	12	14
40,000	-39	-32	-9	-23	-25	-44	-54		35	29	6	20	21	4	-6		27	26	21	25
30,000	-33	-29	-8	-19	-21	-40	-50		29	26	6	16	18	1	-8		30	27	20	24
20,000	-22	-16	-4	-9	-11	-25	-32		20	14	3	8	10	-2	-8		22	20	12	17
SANOSBIT TO VANCOUVER																				
53,000	25	12	8	17	15	5	0		-26	-13	-8	-18	-16	-26	-32		16	14	12	13
40,000	34	22	20	29	26	10	1		-36	-24	-21	-32	-28	-45	-54		24	23	23	26
30,000	32	21	18	23	24	5	-6		-35	-24	-20	-27	-26	-45	-56		28	29	25	29
20,000	21	11	13	17	15	1	-6		-23	-13	-14	-19	-17	-31	-38		23	21	17	21
SAN FRANCISCO TO SEATTLE																				
53,000	-10	-1	5	-1	-1	-11	-16		7	-1	-6	-1	-1	-10	-15		17	14	11	13
40,000	-11	-8	4	-5	-5	-22	-31		5	3	-7	0	0	-17	-26		26	25	22	27
30,000	-11	-7	3	-6	-5	-23	-33		4	2	-6	1	0	-17	-27		30	27	22	28
20,000	-6	-2	1	0	-1	-14	-21		3	0	-2	-2	0	-13	-19		22	20	14	20
SAN FRANCISCO TO WASHINGTON, D.C.																				
53,000	38	28	12	24	25	16	11		-39	-28	-12	-25	-25	-35	-41		11	10	7	9
40,000	61	42	36	41	44	32	26		-64	-44	-38	-44	-46	-60	-67		18	17	15	18
30,000	53	38	28	35	37	25	19		-56	-40	-29	-37	-39	-53	-61		19	18	12	18
20,000	35	25	18	23	24	16	12		-37	-26	-19	-24	-25	-35	-41		14	13	8	13
SASKATOON TO WINNIPEG																				
53,000	30	15	14	24	20	11	7		-30	-16	-15	-24	-20	-30	-36		16	12	10	13
40,000	39	22	32	32	31	16	7		-40	-23	-34	-34	-33	-48	-57		22	20	21	26
30,000	40	23	29	32	31	14	5		-42	-25	-31	-34	-33	-50	-59		25	25	21	27
20,000	29	19	20	25	23	12	6		-30	-20	-21	-26	-24	-35	-42		18	17	14	18
SAULT STE. MARIE TO TORONTO																				
53,000	30	19	13	21	20	9	4		-32	-20	-14	-22	-21	-33	-39		17	15	13	15
40,000	47	31	36	35	37	19	9		-52	-34	-39	-39	-41	-52	-69		28	27	24	28
30,000	46	32	32	33	35	16	6		-52	-35	-34	-37	-39	-52	-70		31	30	23	30
20,000	32	22	22	22	24	10	3		-35	-24	-23	-24	-26	-41	-47		24	23	15	23
SHREVEPORT TO TULSA																				
53,000	-22	-14	-5	-11	-12	-24	-30		16	11	5	9	9	-1	-7		18	17	12	16
40,000	-26	-23	-12	-23	-21	-39	-49		12	15	10	17	14	-4	-13		30	28	21	26
30,000	-21	-19	-9	-20	-16	-34	-43		11	13	8	15	11	-5	-14		29	27	17	28
20,000	-15	-14	-6	-11	-11	-23	-30		11	11	5	9	9	-3	-9		22	20	11	19
SYRACUSE TO WASHINGTON, D.C.																				
53,000	-15	-5	2	-10	-7	-19	-25		10	2	-2	8	4	-7	-13		19	17	13	16
40,000	-20	-12	-4	-20	-13	-33	-44		6	4	-1	12	5	-14	-24		30	29	25	29
30,000	-19	-10	-6	-17	-12	-32	-43		6	3	3	11	5	-13	-23		31	31	21	30
20,000	-14	-3	-4	-11	-8	-22	-30		8	0	2	8	4	-9	-17		24	23	14	23

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.

**A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.

MINUS SIGNS DENOTE HEADWINDS.

THE BOEING COMPANY
TRANSPORT DIVISION

NO. 06-9176

EQUIVALENT HEADWINDS AND STANDARD DEVIATION IN KNOTS FOR GREAT CIRCLE AIR ROUTES

HEIGHT IN FEET	EQUIVALENT HEADWINDS*															STANDARD DEVIATION			
	DIRECT								RETURN										
	JAN	APR	JUL	OCT	**A50	A75	A85	JAN	APR	JUL	OCT	A50	A75	A85	JAN	APR	JUL	OCT	
TAMPA TO TORONTO																			
53,000	7	2	-4	4	2	-7	-12	-13	-5	3	-6	-5	-15	-20	14	14	10	14	953 N.MI.
40,000	5	4	-5	9	3	-12	-20	-19	-12	2	-15	-11	-26	-35	23	23	18	22	
30,000	5	1	-1	8	3	-10	-17	-16	-8	-1	-13	-9	-23	-31	21	22	15	22	
20,000	7	1	1	6	3	-6	-12	-12	-4	-2	-8	-6	-16	-22	17	17	10	16	
TERRACE TO VANCOUVER																			
53,000	20	8	4	11	10	1	-4	-22	-9	-5	-13	-11	-22	-27	16	14	12	12	375 N.MI.
40,000	26	13	12	18	17	1	-8	-29	-16	-14	-22	-20	-36	-45	24	22	23	25	
30,000	24	11	12	13	15	-4	-14	-28	-15	-14	-17	-18	-37	-47	28	29	25	29	
20,000	14	5	8	9	9	-4	-12	-17	-7	-9	-12	-11	-24	-32	23	21	16	20	
TOLEDO TO WASHINGTON, D.C.																			
53,000	39	27	12	23	24	12	6	-41	-29	-12	-24	-25	-39	-47	18	17	12	16	351 N.MI.
40,000	66	44	34	39	45	25	16	-71	-47	-36	-43	-48	-69	-80	29	28	23	28	
30,000	62	40	26	35	39	20	11	-67	-44	-28	-39	-42	-64	-76	28	29	19	29	
20,000	42	30	18	24	27	13	6	-45	-31	-19	-26	-29	-45	-54	23	23	13	22	
TORONTO TO VANCOUVER																			
53,000	-32	-19	-15	-25	-22	-30	-35	31	19	15	25	22	14	11	11	9	8	9	1804 N.MI.
40,000	-47	-30	-37	-39	-38	-50	-57	45	29	36	37	36	25	19	16	15	15	18	
30,000	-48	-31	-34	-39	-37	-50	-58	45	29	32	37	35	23	16	19	19	15	19	
20,000	-33	-22	-22	-27	-25	-35	-40	32	20	22	26	25	16	11	14	13	10	14	
TORONTO TO WASHINGTON, D.C.																			
53,000	10	11	8	6	8	-2	-8	-16	-13	-8	-8	-11	-22	-28	18	17	13	16	313 N.MI.
40,000	21	15	17	9	16	-3	-13	-34	-22	-21	-16	-23	-42	-53	29	28	24	28	
30,000	21	16	12	8	14	-4	-14	-33	-22	-15	-15	-21	-39	-50	29	30	20	30	
20,000	14	15	9	6	10	-3	-10	-20	-18	-10	-9	-14	-28	-36	23	23	14	22	
TORONTO TO WINDSOR																			
53,000	-28	-18	-12	-20	-19	-30	-36	26	16	12	18	17	7	1	18	15	13	15	210 N.MI.
40,000	-47	-31	-35	-35	-37	-56	-66	40	27	32	30	32	14	4	29	27	25	28	
30,000	-47	-33	-31	-33	-35	-55	-66	39	29	28	28	31	12	1	32	31	23	30	
20,000	-31	-22	-21	-21	-23	-38	-46	27	20	20	19	21	7	0	24	23	15	23	
TORONTO TO WINNIPEG																			
53,000	-34	-20	-15	-24	-22	-32	-38	33	19	15	24	22	13	8	15	12	10	12	811 N.MI.
40,000	-51	-33	-41	-41	-41	-57	-65	48	31	39	38	39	24	16	22	21	20	24	
30,000	-50	-34	-36	-39	-39	-56	-65	47	32	35	36	37	21	13	26	25	19	25	
20,000	-35	-23	-25	-26	-27	-39	-46	33	22	24	25	26	14	8	19	18	13	18	
VANCOUVER TO WINNIPEG																			
53,000	27	17	15	24	20	12	8	-27	-17	-15	-24	-20	-29	-33	13	11	9	10	1006 N.MI.
40,000	36	23	29	33	30	17	10	-38	-25	-31	-35	-32	-45	-53	19	18	19	22	
30,000	39	24	29	34	31	16	9	-41	-26	-30	-37	-33	-48	-57	22	22	18	24	
20,000	27	18	19	25	22	12	6	-29	-18	-20	-26	-23	-33	-39	16	15	12	16	
WASHINGTON, D.C. TO WEST PALM BEACH																			
53,000	-14	-6	4	-6	-5	-15	-22	8	2	-4	4	2	-7	-12	15	15	10	15	746 N.MI.
40,000	-20	-16	3	-16	-12	-28	-37	8	7	-4	10	5	-10	-18	23	24	18	23	
30,000	-17	-9	0	-13	-9	-23	-31	8	3	-1	9	4	-9	-16	20	22	14	22	
20,000	-12	-7	-4	-9	-7	-18	-23	8	4	3	8	5	-4	-9	17	17	9	15	
WINDSOR TO WINNIPEG																			
53,000	-33	-19	-16	-25	-22	-32	-38	33	18	15	24	22	13	8	15	12	11	13	611 N.MI.
40,000	-49	-31	-42	-41	-41	-56	-65	47	29	40	33	39	23	15	22	21	21	26	
30,000	-48	-32	-37	-39	-39	-56	-65	46	30	36	37	37	20	11	26	25	20	26	
20,000	-34	-22	-25	-27	-27	-39	-46	33	21	25	26	26	14	8	20	19	13	19	

*HEADWINDS--COMPUTED FOR A 450-KT AIRSPEED.
 **A--DENOTES ANNUAL EQUIVALENT HEADWINDS FOR INDICATED PER CENT RELIABILITIES.
 MINUS SIGNS DENOTE HEADWINDS.

TABLE 5
LIST OF AIRPORTS WITH GEOGRAPHICAL COORDINATES,
ELEVATION AND LENGTH OF LONGEST RUNWAY

AIRPORTS

TABLE 5. LIST OF AIRPORTS

<u>CITY</u>	<u>AIRPORT</u>	<u>CODE</u>	<u>LAT.</u> ° 'N	<u>LONG.</u> ° 'W	<u>ELEV.</u> Ft.	<u>RUNWAY</u> Ft.
Abilene, Texas, USA	Abilene	ABI	32.25	99.41	1778	6,000
Akron, Ohio, USA	Akron-Canton	CAK	40.55	81.27	1228	5,600
Alamogordo, N. Mex., USA	Holloman AFB	ALM	32.51	106.06	4094	12,100
Albany, Ga., USA	Albany	ABY	31.32	84.12	196	5,000
Albany, N. Y., USA	Albany Mun.	ALB	42.45	73.48	288	5,000
Albuquerque, N. Mex., USA	Kirtland AFB	ABQ	35.03	106.36	5352	12,800
Alexandria, La., USA	England AFB	AEX	31.20	92.33	89	9,300
Allentown, Pa., USA	Allentown-Bethlehem-Easton	ABE	40.39	75.26	391	6,100
Amarillo, Texas, USA	Amarillo AFB/Muni	AMA	35.14	101.42	3607	13,500
Anchorage, Alaska, USA	Anchorage Int'l	ANC	61.11	150.00	124	10,600
Anderson, S. C., USA	Anderson Muni	AND	34.30	82.43	782	5,000
Annette Island, Alaska, USA	Annette	ANN	55.02	131.34	119	7,500
Asheville, N. C., USA	Asheville-Hendersonville	AVL	35.26	82.32	2161	6,500
Atlanta, Ga., USA	Atlanta Muni.	ATL	33.39	84.26	1024	7,800
Atlantic City, N. J., USA	Atlantic City NAFEC	NBB	39.27	74.35	76	10,000
Augusta, Ga., USA	Bush Field	AGS	33.22	81.58	142	5,300
Augusta, Me., USA	Augusta State	AUG	44.19	69.47	357	4,200
Austin, Texas, USA	Mueller Muni.	AUS	30.18	97.42	632	6,400
Bakersfield, Calif., USA	Meadows Field	BFL	35.26	119.03	514	5,700
Baltimore, Md., USA	Friendship Int'l	BAL	39.10	76.40	146	9,400
Bangor, Me., USA	Dow AFB	BGR	44.48	68.49	202	11,400
Baton Rouge, La., USA	Ryan	BTR	30.32	91.09	70	6,000
Beaumont, Texas, USA	Jefferson Co.	BUJ	29.57	94.01	15	5,700
Big Mountain, Alaska, USA		BMX	59.22	155.15	663	4,200
Big Spring, Texas, USA	Webb AFB	BGS	32.13	101.31	2561	8,800
Billings, Mont., USA	Logan Field	BIL	45.48	108.32	3606	8,600
Binghamton, N. Y., USA	Broome Co.	BGM	42.13	75.59	1629	5,600
Birmingham, Ala., USA	Birmingham Muni.	BGM	33.34	86.45	643	10,000
Bisbee, Ariz., USA	Bisbee-Douglas Int'l	DUG	31.28	109.36	4158	7,500
Bismark, N. Dak., USA	Bismark Muni.	BIS	46.47	100.45	1653	5,200
Boise, Idaho, USA	Boise Air Terminal	BOI	43.34	116.13	2858	9,000
Boston, Mass., USA	Logan Int'l	BOS	42.22	71.00	19	10,000
Bowling Green, Ky., USA	Warren Co. Muni.	BWG	36.58	86.26	539	5,200
Bozeman, Mont., USA	Gallatin Field	BZN	45.47	111.10	4461	5,200
Bristol, Tenn., USA	Tri-City Muni.	TRI	36.29	82.24	1519	6,600
Brownsville, Texas, USA	Harlingen AFB	HRL	26.13	97.39	35	6,000
Brunswick, Ga., USA	McKinnon	SSI	31.09	81.23	20	4,300
Buffalo, N. Y., USA	Greater Buffalo Int'l	BUF	42.56	78.44	711	5,600
Burbank, Calif., USA	Lockheed Air Terminal	BUR	34.12	118.22	775	6,500
Burlington, Vt., USA	Burlington Muni.	BTB	44.28	73.09	335	7,800
Butte, Mont., USA	Silver Bow Co. Apt.	BTM	45.57	112.30	5554	6,800
Calgary, Alb., CANADA	Calgary	YYC	51.06	114.01	3557	8,700
Carlsbad, N. Mex., USA	Carlsbad Muni.	CNM	32.30	104.16	3276	6,600
Casper, Wyo., USA	Casper Air Terminal	CPR	42.55	106.28	5348	10,600
Castlegar, B. C., CANADA		YCG	49.18	117.38	1620	4,800

<u>CITY</u>	<u>AIRPORT</u>	<u>CODE</u>	<u>LAT.</u> ° ' N	<u>LONG.</u> ° ' W	<u>ELEV.</u> Ft.	<u>RUNWAY</u> Ft.
Cedar Rapids, Iowa, USA	Cedar Rapids Muni.	CID	41.53	91.42	863	5,400
Charleston, S. C., USA	Charleston AFB/Muni.	CHS	32.54	80.02	45	9,000
Charleston, W. Va., USA	Kanawha Co.	CHW	38.22	81.36	982	5,600
Charlotte, N. C., USA	Douglas Muni.	CLT	35.13	80.56	748	7,500
Chattanooga, Tenn., USA	Lovell Field	CHA	35.02	85.12	682	6,200
Cheyenne, Wyo., USA	Cheyenne Muni.	CYS	41.09	104.49	6156	9,300
Chicago, Ill., USA	O'Hare Chicago Int'l	ORD	41.59	87.54	667	11,600
Cincinnati, Ohio, USA	Greater Cincinnati	CUG	39.03	84.40	890	8,600
Cleveland, Ohio, USA	Cleveland-Hopkins	CLE	41.25	81.51	789	9,000
College Station, Texas, USA	Easterwood Field	CLL	30.35	96.22	319	5,200
Colorado Springs, Colo., USA	Peterson Field	COS	38.49	104.43	6172	9,100
Columbia, S. C., USA	Columbia	CAE	33.57	81.07	244	5,200
Columbus, Ga., USA	Muscogee Co.	CSG	32.31	84.57	397	5,000
Columbus, Ohio, USA	Port Columbus	CMH	40.00	82.53	816	10,700
Comox, B. C., CANADA		YQQ	49.43	124.54	83	8,000
Concord, N. H., USA	Concord Muni.	CON	43.12	71.31	345	5,000
Corpus Christi, Texas, USA	Corpus Christi Int'l	CRP	27.46	97.30	44	5,600
Cranbrook, B. C., CANADA		YXC	49.32	115.46	2997	4,900
Dallas, Texas, USA	Love Field	DAL	32.51	96.51	485	7,700
Dawson City, Y. T., CANADA		YQD	64.03	139.05	1211	4,000
Dayton, Ohio, USA	Dayton Muni.	DAY	39.54	84.13	1008	7,000
Daytona Beach, Fla., USA	Daytona Beach Muni.	DAB	29.11	81.03	34	5,700
Denver, Colo., USA	Stapleton Airfield	DEN	39.46	104.53	5331	10,000
Des Moines, Iowa, USA	Des Moines	DSM	41.32	93.39	957	7,500
Detroit, Mich., USA	Detroit Metropolitan Wayne Co.	YIP	42.14	83.21	639	10,500
Dothan, Ala., USA	Dothan	DHN	31.14	85.27	330	4,000
Easton, Pa., USA	Easton	ABE	40.44	75.15	380	2,200
Edmonton, Alb., CANADA	Edmonton Int'l	YXD	53.19	113.35	2373	11,000
Elko, Nev., USA	Elko	EKO	40.50	115.48	5135	6,400
Elmira, N. Y., USA	Chemung Co.	ELM	42.09	76.54	951	4,700
El Paso, Texas, USA	El Paso Int'l	ELP	31.48	106.23	3939	11,000
Ely, Nev., USA	Ely	ELY	39.18	114.51	6258	6,000
Eugene, Ore., USA	Mahlon-Sweet Field	EUG	44.08	123.13	365	5,500
Evansville, Ind., USA	Dress Memorial	EVV	38.03	87.32	389	6,000
Fairbanks, Alas., USA	Fairbanks Int'l	FAI	64.49	147.51	434	10,300
Fargo, N. Dak., USA	Hector Field	FAR	46.55	96.49	900	7,100
Fayetteville, Ark., USA	Fayetteville-Drake Field	FYV	36.00	94.10	1250	5,000
Fitchburg, Mass., USA	Fitchburg Muni.	FIT	42.33	71.45	350	4,500
Flint, Mich., USA	Bishop	FNT	42.58	83.45	781	5,000
Florence, S. C., USA	Florence Muni.	FLO	34.11	79.43	146	6,000
Ft. Lauderdale, Fla., USA	Broward Co. Int'l	FLL	26.04	80.10	10	6,500
Ft. Meyers, Fla., USA	Page Field	FMY	26.35	81.52	17	5,000
Ft. Nelson, B. C., CANADA		YYE	58.50	122.35	1253	6,400
Ft. St. John, B. C., CANADA		YXJ	56.14	120.44	2280	6,700
Ft. Smith, Ark., USA	Ft. Smith Muni.	FSM	35.20	94.22	468	8,000

<u>CITY</u>	<u>AIRPORT</u>	<u>CODE</u>	<u>LAT.</u> ° ' N	<u>LONG.</u> ° ' W	<u>ELEV.</u> Ft.	<u>RUNWAY</u> Ft.
Ft. Wayne, Ind., USA	Baer Field	FWA	40.59	85.12	801	7,000
Ft. William, Ont., CANADA	Lakehead	YQT	48.20	89.23	653	6,200
Ft. Worth, Texas, USA	Amon Carter Field	ACF	32.50	97.03	568	8,400
Fredericton, N. Brunswick, CANADA		YFC	45.52	66.32	67	6,000
Fresno, Calif., USA	Fresno Air Terminal	FAT	36.46	119.43	331	7,100
Gainesville, Fla., USA	Gainesville	GNV	29.42	82.16	155	5,000
Gander, Nfld., CANADA	Gander Int'l	YQX	48.57	53.34	496	8,600
Glens Falls, N. Y., USA	Warren Co.	GFL	43.21	73.37	328	5,000
Goose Bay, Lab., Nfld, CAN.	Goose	YYR	53.19	60.25	150	11,000
Grand Forks, N. Dak., USA	Grand Forks Int'l	GFK	47.56	97.06	836	4,900
Grand Junction, Colo., USA	Walker Field	GJT	39.06	108.32	4858	5,400
Grand Prairie, Alb., CANADA		YQU	55.11	118.53	2193	6,500
Grand Rapids, Mich., USA	Kent Co.	GRR	42.54	85.40	692	5,700
Great Falls, Mont., USA	Great Falls Int'l	GTF	47.29	111.22	3671	9,000
Greensboro, N. C., USA	Greensboro-High Point	GSO	36.06	79.57	922	5,500
Greenville, S. C., USA	Greenville Muni.	GRL	34.51	82.21	1047	5,400
Halifax, N. S., CANADA	Halifax Int'l	YXF	44.53	63.31	476	8,800
Harrisburg, Pa., USA	Harrisburg-York State	HAR	40.13	76.51	347	5,000
Hartford, Conn., USA	Brainard	BDL	41.44	72.39	18	3,400
Helena, Mont., USA	Helena	HLN	46.36	111.59	3881	5,100
Hobbs, N. Mex., USA	Hobbs Muni.	HOB	32.46	103.13	3707	8,800
Homer, Alaska, USA	Homer Muni.	HOM	59.38	151.29	96	5,000
Honolulu, Hawaii, USA	Honolulu Int'l	HNL	21.10	157.51	13	12,380
Hot Springs, Ark., USA	Memorial Field	HOT	34.29	93.06	535	5,000
Houlton, Me., USA	Houlton Int'l	HUL	46.07	67.48	493	5,000
Houston, Texas, USA	Houston Int'l	HOU	29.39	95.16	50	7,600
Huntington, W. Va., USA	Tri-State,	HTS	38.22	82.33	828	5,300
Huntsville, Ala., USA	Huntsville Muni.	HSV	34.41	86.35	619	5,200
Huron, S. Dak., USA	Howes Muni.	HON	44.23	98.14	1287	5,100
Hyannis, Mass., USA	Barnstable Muni.	HYA	41.40	70.17	52	5,000
Idaho Falls, Idaho, USA	Fanning Field	IDA	43.31	112.04	4738	6,600
Indianapolis, Ind., USA	Weir Cook	IND	39.44	86.17	797	7,300
Jackson, Miss., USA	Hawkins Field	JAN	32.20	90.14	343	5,400
Jacksonville, Fla., USA	Imeson Field	JAX	30.25	81.38	52	7,000
Jamestown, N. Dak., USA	Jamestown Muni.	JMS	46.56	98.41	1498	5,700
Joplin, Mo., USA	Joplin	JLN	37.09	94.30	980	5,500
Juneau, Alaska, USA	Juneau Muni.	JNU	58.21	134.35	26	6,400
Kansas City, Mo., USA	Kansas City Muni.	MKC	39.07	94.36	758	7,000
Keene, N. H., USA	Dillant-Hopkins	EEN	42.54	72.16	482	4,500
Key West, Fla., USA	Key West Int'l	EYW	24.34	81.46	4	4,800
King Salmon, Alaska, USA		AKN	58.41	156.39	55	7,500
Knoxville, Tenn., USA	McGhee-Tyson	TYS	35.49	83.59	989	7,500
Kodiak, Alaska, USA	Kodiak NAS	NBH	57.45	152.29	77	7,500

<u>CITY</u>	<u>AIRPORT</u>	<u>CODE</u>	<u>LAT.</u> ° ' N	<u>LONG.</u> ° ' W	<u>ELEV.</u> Ft.	<u>RUNWAY</u> Ft.
Laconia, N. H., USA	Laconia Muni.	LCI	43.34	71.26	552	3,500
Lafayette, La., USA	Lafayette Muni.	LFT	30.13	92.00	41	5,000
Lake Charles, La., USA	Chennault AFB/Muni.	LKC	30.13	93.10	19	11,400
Lakeland, Fla., USA	Drane Field	LAL	28.00	82.01	142	5,000
Lancaster, Pa., USA	Lancaster	LNS	40.07	76.18	403	5,000
Land O'Lakes, Wisc., USA	Kings Gateway	LNL	46.09	89.12	1706	4,400
Lansing, Mich., USA	Capital City	LAN	42.47	84.35	859	5,000
Las Vegas, Nev., USA	McCarran Field	LAS	36.05	115.10	2171	10,000
Lawrence, Mass., USA	Lawrence	LWM	42.43	71.08	165	5,000
Lawton, Okla., USA	Lawton Muni.	LAW	34.34	98.24	1108	5,400
Lebanon, N. H., USA	Lebanon Regional	LEB	43.38	72.18	580	5,500
Lethbridge, Alberta, CANADA		YLQ	49.38	112.48	3047	6,500
Lewiston, Me., USA	College Road	LEW	44.07	70.11	210	
Lexington, Ky., USA	Blue Grass Field	LEX	38.02	84.36	978	5,500
Lincoln, Neb., USA	Lincoln AFB	LNK	40.51	96.46	1195	12,900
Little Rock, Ark., USA	Adams Field	LIT	34.44	92.14	257	7,000
Long Beach, Calif., USA	Long Beach	LGB	33.49	118.09	56	10,000
Los Angeles, Calif., USA	Los Angeles Int'l	LAX	33.56	118.24	126	12,000
Louisville, Ky., USA	Standiford	SDF	38.11	85.44	497	7,800
Lubbock, Texas, USA	Lubbock Muni.	LBB	33.40	101.49	3256	8,500
Macon, Ga., USA	Macon Muni.	MCN	32.41	83.39	354	5,000
Madison, Wisc., USA	Madison Muni.	MSN	43.09	89.20	859	7,600
Manchester, N. H., USA	Hooksett-Manchester	MHT	43.04	71.28	187	7,000
Martha's Vineyard, Vineyard Haven, Mass., USA	Martha's Vineyard	MVY	41.24	70.37	68	5,000
Massena, N. Y., USA	Richards Field	MSS	44.56	74.51	215	5,000
Mayo, Y. T., CANADA		YMA	63.37	135.52	1625	3,200
McAlester, Okla., USA	McAlester Muni.	MLC	34.53	95.47	770	4,000
Medford, Ore., USA	Medford Muni.	MFR	42.23	122.53	1330	5,400
Melbourne, Fla., USA	Melbourne-Eau Gallie	MLB	28.06	80.38	26	5,200
Memphis, Tenn., USA	Memphis Muni.	MEM	35.04	89.59	291	8,900
Merced, Calif., USA	Merced Muni.	MCE	37.17	120.31	155	4,700
Meridian, Miss., USA	Key Field	MEI	33.21	88.45	297	8,000
Miami, Fla., USA	Miami Int'l	MIA	25.48	80.17	9	10,500
Midland, Texas, USA	Midland Air Terminal	MAF	31.57	102.12	2867	6,600
Milwaukee, Wisc., USA	Gen. Mitchell Field	MKE	42.57	87.54	702	9,900
Minneapolis/St. Paul, Minn., USA	Minneapolis/St. Paul Int'l	MSP	44.53	93.13	840	8,200
Missoula, Mont., USA	Missoula Co.	MSO	46.55	114.05	3203	7,000
Mobile, Ala., USA	Bates Field	MOB	30.41	88.14	217	6,000
Modesto, Calif., USA	Modesto-City-County	MOD	37.38	120.57	96	5,000
Moline, Ill., USA	Quad-City	MLI	41.27	90.31	590	5,500
Moncton, New Bruns., CANADA		YQM	46.07	64.41	232	6,200
Monroe, La., USA	Selman Field	MLU	32.30	92.02	79	5,000
Monterey, Calif., USA	Monterey Peninsula	MRY	36.35	121.51	220	5,000
Montgomery, Ala., USA	Dannelly Field	MGM	32.18	86.24	221	8,000
Montpelier, Vt., USA	Barre-Montpelier Muni.	MPV	44.12	72.34	1157	4,500
Montreal, Que., CANADA	Montreal Int'l	YUL	45.28	73.45	117	9,600

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Muscle Shoals, Ala., USA	Muscle Shoals	MSL	34.45	87.37	548	4,900
Muskegon, Mich., USA	Muskegon Co.	MKG	43.11	86.14	628	5,000
Nantucket, Mass., USA	Nantucket Memorial	ACK	41.16	70.04	48	5,000
Nashville, Tenn., USA	Nashville-Berry-Field	BNA	36.08	86.41	597	8,000
New Bedford, Mass., USA	New Bedford Muni.	EWB	41.40	70.58	79	5,000
New Bern, N. C., USA	Simmons-Nott	EWN	35.04	77.03	18	4,800
New Haven, Conn., USA	New Haven Muni.	NHV	41.16	72.53	15	4,700
New Orleans, La., USA	Moisant Int'l	MSV	20.00	90.15	3	8,500
Newport News, Va., USA	Patrick Henry	PHF	37.08	76.30	41	5,600
New York, N. Y., USA	N.Y. Int'l (Idlewild)	IDL	40.38	73.47	12	14,600
Norfolk, Va., USA	Norfolk Muni.	ORF	36.54	76.12	26	5,000
North Bay, Ont., CANADA		YYB	46.22	79.25	1215	8,200
Oakland, Calif., USA	Oakland	OAK	37.44	122.13	5	6,200
Ocala, Fla., USA	Taylor Field	OCF	29.11	82.09	84	4,000
Oklahoma City, Okla., USA	Will Rogers	OKC	35.24	97.37	1284	9,800
Omaha, Nebr., USA	Lincoln AFB	OMH	40.51	96.46	1195	12,900
Ontario, Calif., USA	Ontario Int'l	ONT	34.03	117.37	952	8,200
Orlando, Fla., USA	Orlando Muni-Herndon	ORL	28.33	81.20	113	6,000
Ottawa, Ont., CANADA		YOW	45.19	75.40	374	8,800
Owensboro, Ky., USA	Owensboro-Daviess Co.	OWB	37.45	87.10	407	5,000
Paducah, Ky., USA	Barkley Field	PUK	37.04	88.46	407	5,000
Palm Springs, Calif., USA	Palm Springs	PSP	33.50	116.30	448	7,000
Panama City, Fla., USA	Fannin	PFN	30.13	85.41	14	4,900
Pendleton, Ore., USA	Pendleton Field	PDT	45.41	118.50	1493	6,300
Pensacola, Fla., USA	Pensacola Muni.	PNS	30.28	87.12	121	5,000
Penticton, B. C., CANADA		YYF	49.28	119.36	1129	6,000
Philadelphia, Pa., USA	Philadelphia Int'l	PHL	39.53	75.14	14	9,500
Phoenix, Ariz., USA	Phoenix-Sky Harbor Muni.	PHX	33.26	112.01	1122	8,800
Pierre, S. Dak., USA	Pierre Muni.	PIR	44.23	100.17	1742	7,200
Pittsburgh, Pa., USA	Greater Pittsburgh	PIT	40.29	80.13	1168	7,500
Pittsfield, Mass., USA	Pittsfield Muni.	PSF	42.26	73.18	1170	3,500
Pocatello, Ida., USA	Pocatello Muni.	PIH	42.55	112.36	4448	8,300
Port Hardy, B. C., CANADA		YZT	50.41	127.22	80	5,000
Portland, Me., USA	Portland Muni.	PWM	43.39	70.19	66	5,000
Portland, Ore., USA	Portland Int'l	PDX	45.35	122.36	23	8,800
Presque Isle, Me., USA	Presque Isle Muni.	PQI	46.41	68.03	534	7,400
Prince George, B. C., CAN.		YXS	53.53	122.41	2268	5,700
Prince Rupert, B. C., CAN.		YPR	54.17	130.27	111	6,000
Providence, R. I., USA	Green	PVD	41.44	71.26	56	5,400
Pueblo, Colo., USA	Pueblo Memorial	PUB	38.18	104.30	4725	8,800
Quebec, Que., CANADA		YQB	46.48	71.23	239	6,000
Quesnel, B. C., CANADA		YQZ	53.05	122.31	1789	5,500
Raleigh, N. C., USA	Raleigh-Durham	RDU	35.52	78.47	435	5,500
Rapid City, S. Dak., USA	Rapid City Muni.	RAP	44.03	103.03	3181	6,200

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Reading, Pa., USA	Gen. Spaatz Field	RDG	40.23	75.58	343	5,100
Regina, Sask., CANADA		YQR	50.26	104.40	1893	6,900
Reno, Nev., USA	Reno Muni.	RNO	39.30	119.46	4411	7,800
Richmond, Va., USA	Byrd Field	RIC	37.30	77.19	167	8,000
Roanoke, Va., USA	Roanoke Muni.	ROA	37.19	79.58	1174	5,400
Rochester, Minn., USA	Rochester Muni. Aprt.	RST	43.55	92.30	1310	6,400
Rochester, N. Y., USA	Rochester-Monroe	ROC	43.07	77.40	560	5,000
Rockland, Me., USA	Rockland Muni.	RKD	44.04	69.06	60	4,500
Rome, Ga., USA	Russell Field	RMG	34.21	85.10	644	4,500
Roswell, N. Mex., USA	Roswell Muni.	ROW	33.25	104.33	3623	5,600
Rouyn-Noranda, Que., CANADA		YUY	48.13	79.05	987	5,600
Sacramento, Calif., USA	Sacramento	SAC	38.31	121.19	21	
Saginaw, Mich., USA	Tri-City	MBS	43.32	84.05	667	5,600
Saguenay, Que., CANADA		YBG	48.30	71.00		
St. John, N. B., CANADA	St. John Muni.	YSJ	45.19	65.53	356	5,500
St. Johns, Nfld., CANADA	Torbay	YYT	47.47	52.45	484	7,000
St. Louis, Mo., USA	Lambert-St. Louis Muni.	STL	38.45	90.22	571	10,000
St. Petersburg, Fla., USA	St. Petersburg-Clearwater Int'l	PIE	27.55	82.42	10	8,000
Salem, Ore., USA	Salem-McNary Field	SLE	44.55	123.00	207	5,500
Salinas, Calif., USA	Salinas Muni.	SNS	36.40	121.36	84	5,000
Salt Lake City, Utah, USA	Salt Lake City Muni.	SLC	40.47	111.58	4226	10,000
San Angelo, Texas, USA	Mathis Field	SJT	31.22	100.30	1915	5,900
San Antonio, Texas, USA	San Antonio Int'l	SAT	29.32	98.28	800	8,500
San Diego, Calif., USA	Lindbergh Field	SAN	32.44	117.11	15	8,100
Sandspit, B. C., CANADA		YZP	53.15	131.49	16	5,100
San Francisco/Oakland, Calif., USA	San Francisco Int'l	SFO	37.38	122.23	10	9,500
Santa Barbara, Calif., USA	Santa Barbara Muni.	SBA	34.26	119.50	14	4,700
Santa Fe, N. Mex., USA	Santa Fe Co. Muni.	SAF	35.37	106.05	6344	8,300
Sarasota, Fla., USA	Sarasota-Branden	SRQ	27.24	82.33	24	5,000
Saskatoon, Sask., CANADA		YXE	52.10	106.41	1653	8,300
Sault Ste. Marie, Ont., CAN.			46.29	84.30	631	6,000
Savannah, Ga., USA	Hunter Field (Muni.)	SAV	32.01	81.08	40	11,400
Scranton, Pa., USA	Scranton	AVP	41.29	75.46	1179	2,400
Seattle, Wash., USA	Seattle-Tacoma Int'l	SEA	47.27	122.19	428	9,800
Seven Islands, Que., CAN.		YZV	50.13	66.16	180	6,600
Sharon, Pa., USA	Sharon	YNG	41.13	80.27	1140	2,400
Sheridan, Wyo., USA	Sheridan Co.	SHR	44.47	106.58	4021	6,000
Shreveport, La., USA	Greater Shreveport	SHV	32.27	93.49	251	6,400
Sioux City, Iowa, USA	Sioux City Muni.	SUX	42.24	96.23	1097	9,000
Sioux Falls, S. Dak., USA	Foss Field	FSD	43.35	96.45	1426	7,100
Smithers, B. C., CANADA		YZV	54.49	127.11	1719	5,000
South Bend, Ind., USA	St. Joseph Co.	SBN	41.42	86.19	778	5,000
Spartanburg, S. C., USA	Spartanburg Muni.	SPA	34.55	81.58	816	5,000
Spokane, Wash., USA	Spokane Int'l	GEG	47.38	117.38	2462	13,900
Springfield, Ill., USA	Capital	SPI	39.15	89.40	593	7,000
Springfield, Mo., USA	Springfield Muni.	SGV	37.15	93.23	1267	5,600

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Stephenville, Nfld., CAN.	Ernst Harmon AFB	YJT	48.32	58.33	86	10,000
Stockton, Calif., USA	Stockton Muni.	SCK	37.54	121.15	27	8,600
Sudbury, Ont., CANADA		YSB	46.37	80.48	1120	6,600
Swift Current, Sask., CANADA		YYN	50.17	107.41	2680	4,200
Sydney, N. S., CANADA		YQY	46.10	60.03	202	6,000
Syracuse, N. Y., USA	Hancock	SYR	43.07	76.07	421	8,000
Tallahassee, Fla., USA	Tallahassee Muni.	TLH	30.24	84.21	82	6,100
Tampa, Fla., USA	Tampa Int'l	TPA	27.58	82.32	27	8,300
Temple, Texas, USA	Draughton-Miller Muni.	TPL	31.09	97.25	698	5,000
Terrace, B. C., CANADA		YXT	54.28	128.35	713	5,200
Terre Haute, Ind., USA	Hulman Field	HUF	39.27	87.19	585	8,000
Texarkana, Ark., USA	Texarkana Muni	TXK	33.27	94.00	389	5,200
Timmins, Ont., USA		YTS	48.34	81.22	967	5,700
Toledo, Ohio, USA	Toledo Express	TOL	41.35	83.48	684	7,000
Toronto, Ont., CANADA	Toronto Int'l (Malton)	YYZ	43.41	79.38	567	11,000
Tucson, Ariz., USA	Tucson Muni.	TUS	32.07	110.57	2630	12,000
Tulsa, Okla., USA	Tulsa Muni.	TUL	36.12	95.53	674	10,000
Val D'Or, Que., CANADA		YVO	48.03	77.47	1109	8,200
Vancouver, B. C., CANADA	Sea Island	YVR	49.11	123.10	9	8,600
Vero Beach, Fla., USA	Vero Beach Muni.	VRB	27.39	80.25	24	7,200
Victoria, B. C., CANADA	Victoria Int'l	YYJ	48.39	123.26	63	5,000
Visalia, Calif., USA	Visalia Muni.	VIS	36.19	119.24	292	5,300
Waco, Texas, USA	Waco Muni.	ACT	31.37	97.14	515	5,700
Washington, D. C., USA	Washington Nat'l	DCA	38.51	77.02	15	6,900
Waterloo, Iowa, USA	Waterloo Muni.	ALO	42.34	92.24	870	5,400
Waterville, Maine, USA	Waterville Muni.	WVL	44.32	69.40	332	4,000
Watson Lake, Y. T., CANADA		YQH	60.07	128.49	2255	5,500
Waycross, Ga., USA	Waycross-Ware Co.	AYS	31.15	82.24	142	5,000
West Palm Beach, Fla., USA	Palm Beach Int'l	PBI	26.41	80.06	19	8,000
Whitehorse, Y. T., CANADA		YXE	60.43	135.04	2303	7,200
Wichita, Kan., USA	Wichita	ICT	37.39	97.26	1332	7,300
Wichita Falls, Texas, USA	Wichita Falls	SPS	33.59	98.30	1015	13,100
Williams Lake, B. C., CAN.		YWL	52.11	122.03	3085	7,000
Williamsport, Pa., USA	Williamsport- Lycoming Co.	IPT	41.14	76.55	528	5,000
Wilmington, Del., USA	Greater Wilmington	ILG	39.41	75.36	79	7,100
Wilmington, N. C., USA	New Hanover Co.	IMN	34.16	77.54	31	8,000
Windsor, Ont., CANADA		YQG	46.16	82.58	622	6,200
Winnipeg, Man., CANADA	Winnipeg Int'l	YWG	49.54	97.14	785	8,700
Worcester, Mass., USA	Worcester Muni.	ORH	42.16	71.52	1009	5,500
Yakima, Wash., USA	Yakima Muni.	YKM	46.34	120.32	1082	5,500
Yarmouth, N. S., CANADA		YQI	43.50	66.05	157	5,800
Yorkton, Sask., CANADA		YQV	51.16	102.28	1635	4,800
Youngstown, Ohio, USA	Youngstown Muni.	YNG	41.16	80.41	1196	7,500

TABLE 6
ROUTES INDEXED ALPHABETICALLY
AND UNDER BOTH TERMINALS

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Toledo - - - - -	24			Atlanta - - - - -	27		
Washington, D.C. - - -	24,83	ANDERSON		Charleston, S. C. - - -	29	BIG SPRING	
Youngstown - - - - -	24	Atlanta - - - - -	27	Columbia - - - - -	29	Abilene - - - - -	23
		Greenville - - - - -	27	Jacksonville - - - - -	29	Midland - - - - -	32
ALAMOGORDO		ANNETTE ISLAND		Savannah - - - - -	30		
Albuquerque - - - - -	24	Juneau - - - - -	85	AUGUSTA, ME.		BILLINGS	
El Paso - - - - -	24	Seattle - - - - -	85	Bangor - - - - -	30	Bismark - - - - -	32,90
				Lewiston - - - - -	30	Bozeman - - - - -	33
ALBANY, GA.		ASHEVILLE		Rockland - - - - -	30	Casper - - - - -	33
Atlanta, Ga. - - - - -	24	Atlanta - - - - -	27			Great Falls - - - - -	33
Macon - - - - -	24	Bristol - - - - -	27	AUSTIN		Sheridan - - - - -	33
Tallahassee - - - - -	24	Charlotte - - - - -	27	Dallas - - - - -	30		
Tampa - - - - -	24,83	Greensboro - - - - -	27	Ft. Worth - - - - -	30	BINGHAMPTON	
		Knoxville - - - - -	27	Houston - - - - -	30	Albany, N. Y. - - - - -	24
ALBANY, N. Y.		ATLANTA		San Angelo - - - - -	30	Pittsburgh - - - - -	33,90
Binghamton - - - - -	24	Albany, Ga. - - - - -	24	San Antonio - - - - -	30	Scranton - - - - -	33
Boston - - - - -	24	Anderson - - - - -	27	Waco - - - - -	30	Syracuse - - - - -	33
Buffalo - - - - -	24,83	Asheville - - - - -	27			BIRMINGHAM	
Glens Falls - - - - -	25	Augusta, Ga. - - - - -	27	BAKERSFIELD		Atlanta - - - - -	27
Hartford - - - - -	25	Baltimore - - - - -	85	Fresno - - - - -	30	Charlotte - - - - -	33,90
New York - - - - -	25	Birmingham - - - - -	27	Los Angeles - - - - -	30	Chattanooga - - - - -	33
Rochester, N. Y. - - -	25	Charleston, S. C. - - -	27,86	Visalia - - - - -	30	Chicago - - - - -	90
Syracuse - - - - -	25	Charleston, W. Va. - - -	27,86			Greensboro - - - - -	33,90
		Charlotte - - - - -	27	BALTIMORE		Huntsville - - - - -	33
ALBUQUERQUE		Chattanooga - - - - -	27	Atlanta - - - - -	85	Jackson - - - - -	33
Alamogordo - - - - -	24	Chicago - - - - -	86	Boston - - - - -	30,88	Knoxville - - - - -	33
Amarillo - - - - -	25,83	Cincinnati - - - - -	28,86	Buffalo - - - - -	31,88	Memphis - - - - -	33
Chicago - - - - -	83	Cleveland - - - - -	86	Charlotte - - - - -	31,88	Meridian - - - - -	34
Dallas - - - - -	83	Columbia - - - - -	28	Chicago - - - - -	88	Mobile - - - - -	34
Denver - - - - -	25,83	Columbus, Ga. - - - - -	28	Dallas - - - - -	88	Montgomery - - - - -	34
El Paso - - - - -	25	Dallas - - - - -	86	Denver - - - - -	89	Muscle Shoals - - - - -	34
Las Vegas - - - - -	83	Detroit - - - - -	86	Detroit - - - - -	31,89	New Orleans - - - - -	34,90
Los Angeles - - - - -	84	Greensboro - - - - -	28,86	Harrisburg - - - - -	31	New York - - - - -	90
Lubbock - - - - -	25,84	Greenville - - - - -	28	Houston - - - - -	89	Pensacola - - - - -	34
Phoenix - - - - -	25,84	Houston - - - - -	86	Kansas City - - - - -	89	Pittsburgh - - - - -	90
Roswell - - - - -	25	Indianapolis - - - - -	28,86	Lancaster - - - - -	31	Washington, D. C. - - -	90
San Francisco - - - - -	84	Jacksonville - - - - -	28,86	Los Angeles - - - - -	89		
Santa Fe - - - - -	25	Knoxville - - - - -	28	Miami - - - - -	89	BISBEE	
Wichita - - - - -	84	Los Angeles - - - - -	86	Montreal - - - - -	31,89	El Paso - - - - -	34
		Louisville - - - - -	28,87	New York - - - - -	31	Tucson - - - - -	34
ALEXANDRIA		Macon - - - - -	28	Norfolk - - - - -	31		
Baton Rouge - - - - -	25	Melbourne - - - - -	28,87	Philadelphia - - - - -	31	BISMARK	
Shreveport - - - - -	25	Memphis - - - - -	28,87	Phoenix - - - - -	89	Billings - - - - -	32,90
		Miami - - - - -	87	Pittsburgh - - - - -	31	Fargo - - - - -	34
ALLENTOWN		Mobile - - - - -	28,87	Providence - - - - -	31,89	Jamestown - - - - -	34
Cleveland - - - - -	26,84	Montgomery - - - - -	28	Richmond - - - - -	31	Minneapolis - - - - -	34,91
Harrisburg - - - - -	26	Nashville - - - - -	29				
New York - - - - -	26	New Orleans - - - - -	29,87	Rochester, N. Y. - - -	31,89	BOISE	
Philadelphia - - - - -	26	New York - - - - -	87	St. Louis - - - - -	89	Denver - - - - -	91
Pittsburgh - - - - -	26,84	Norfolk - - - - -	87	San Francisco - - - - -	89	Pendleton - - - - -	34
Reading - - - - -	26	Orlando - - - - -	29,87	Syracuse - - - - -	31,90	Portland, Ore. - - - - -	34,91
Scranton - - - - -	26	Philadelphia - - - - -	87	Tampa - - - - -	90	Reno - - - - -	34,91
Syracuse - - - - -	26			Washington, D. C. - - -	32	Salt Lake City - - - - -	35,91
Washington, D.C. - - -	26			Wilmington, Del. - - -	32		

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San Francisco	- - - - 91	Los Angeles	- - - - 37	Washington, D. C.	- - 41,94	Las Vegas	- - - - 96
Seattle	- - - - 35,91	San Francisco	- - - - 37,93			Los Angeles	- - - - 96
BOSTON		BURLINGTON		CHARLOTTE		Louisville	- - - - 43,96
Albany, N. Y.	- - - - 24	Boston	- - - - 35	Asheville	- - - - 27	Madison	- - - - 43
Baltimore	- - - - 30,88	Montpelier	- - - - 38	Atlanta	- - - - 27	Memphis	- - - - 97
Bangor	- - - - 32			Baltimore	- - - - 31,88	Miami	- - - - 97
Buffalo	- - - - 35,91	BUTTE		Birmingham	- - - - 33,90	Milwaukee	- - - - 43
Burlington	- - - - 35	Bozeman	- - - - 36	Charleston, S. C.	- - 39	Minneapolis	- - - - 43,97
Chicago	- - - - 91	Great Falls	- - - - 38	Charleston, W. Va.	- - 40	Moline	- - - - 43
Cleveland	- - - - 91	Helena	- - - - 38	Chattanooga	- - - - 41,94	Montreal	- - - - 97
Concord	- - - - 35	Idaho Falls	- - - - 38	Chicago	- - - - 94	Muskegon	- - - - 43
Dallas	- - - - 91			Cleveland	- - - - 41,94	Nashville	- - - - 43,97
Denver	- - - - 91	CALGARY		Columbia	- - - - 41,94	New Orleans	- - - - 97
Detroit	- - - - 92	Cranbrook	- - - - 38	Columbus, Ohio	- - - - 41,94	New York	- - - - 97
Fitchburg	- - - - 35	Edmonton	- - - - 38	Danville	- - - - 41	Omaha	- - - - 97
Hartford	- - - - 35	Great Falls	- - - - 38,93	Greensboro	- - - - 41	Philadelphia	- - - - 97
Hyannis	- - - - 35	Lethbridge	- - - - 38,93	Greenville	- - - - 41	Phoenix	- - - - 97
Lebanon	- - - - 35	Regina	- - - - 38,93	Jacksonville	- - - - 41,94	Pittsburgh	- - - - 43,97
Lewiston	- - - - 35	Saskatoon	- - - - 38,93	Miami	- - - - 94	Portland, Ore.	- - - - 97
Los Angeles	- - - - 92	Toronto	- - - - 93	New York	- - - - 94	Providence	- - - - 98
Manchester	- - - - 35	Vancouver	- - - - 38,93	Philadelphia	- - - - 41,94	Rochester, Minn.	- - - - 98
Miami	- - - - 92			Raleigh	- - - - 41	Rochester, N. Y.	- - - - 44,98
Montreal	- - - - 35,92	CARLSBAD		Richmond	- - - - 41,95	Saginaw	- - - - 44
New Bedford	- - - - 35	El Paso	- - - - 38	Spartanburg	- - - - 42	St. Louis	- - - - 44,98
New York	- - - - 35	Hobbs	- - - - 38	Washington, D. C.	- - 42,95	Salt Lake City	- - - - 98
Philadelphia	- - - - 36,92					San Francisco	- - - - 98
Pittsburgh	- - - - 92	CASPER		CHATTANOOGA		Seattle	- - - - 98
Portland, Me.	- - - - 36	Billings	- - - - 33	Atlanta	- - - - 27	South Bend	- - - - 44
Providence	- - - - 36	Cheyenne	- - - - 38	Birmingham	- - - - 33	Spokane	- - - - 98
San Francisco	- - - - 92	Denver	- - - - 39,93	Charlotte	- - - - 41,94	Springfield, Ill.	- - - - 44
Syracuse	- - - - 36,92	Rapid City	- - - - 39	Cincinnati	- - - - 42,95	Tampa	- - - - 98
Tampa	- - - - 92	Salt Lake City	- - - - 39,93	Cleveland	- - - - 41	Toledo	- - - - 44
Washington, D. C.	- - 36,92	Sheridan	- - - - 39	Greenville	- - - - 42	Toronto	- - - - 44,98
Worcester	- - - - 36			Knoxville	- - - - 42	Tucson	- - - - 98
		CASTLEGAR		Lexington	- - - - 42	Tulsa	- - - - 98
		Cranbrook	- - - - 39	Memphis	- - - - 42,95	Washington, D. C.	- - 99
		Penticton	- - - - 39	Nashville	- - - - 42	Waterloo	- - - - 44,99
				Rome	- - - - 42	West Palm Beach	- - - 99
		CEDAR RAPIDS		Washington, D. C.	- - 95		
		Chicago	- - - - 39			CINCINNATI	
		Des Moines	- - - - 39	CHEYENNE		Akron	- - - - 23
		Minneapolis	- - - - 39	Casper	- - - - 38	Atlanta	- - - - 28,86
		Moline	- - - - 39	Denver	- - - - 42	Charleston, W. Va.	- - 40
						Chattanooga	- - - - 42,95
		CHARLESTON, S. C.		CHICAGO		Chicago	- - - - 42,95
		Atlanta	- - - - 27,86	Akron	- - - - 23,83	Cleveland	- - - - 44
		Augusta, Ga.	- - - - 29	Albuquerque	- - - - 83	Columbus, Ohio	- - - - 44
		Charlotte	- - - - 39	Anchorage	- - - - 85	Dallas	- - - - 99
		Columbia	- - - - 39	Atlanta	- - - - 86	Dayton	- - - - 44
		Florence	- - - - 39	Baltimore	- - - - 88	Detroit	- - - - 44,99
		Jacksonville	- - - - 39	Birmingham	- - - - 90	Ft. Lauderdale	- - - 99
		Norfolk	- - - - 40,94	Boston	- - - - 91	Indianapolis	- - - 44
		Savannah	- - - - 40	Buffalo	- - - - 36,92	Knoxville	- - - - 44
		Wilmington, N. C.	- - 40	Cedar Rapids	- - - - 39	Lexington	- - - - 45
				Charlotte	- - - - 94	Los Angeles	- - - - 99
		CHARLESTON, W. VA.		Cincinnati	- - - - 42,95	Louisville	- - - - 45
		Akron	- - - - 23	Cleveland	- - - - 42,95	Miami	- - - - 99
		Atlanta	- - - - 27,86	Columbus, Ohio	- - - - 42,95	Nashville	- - - - 45
		Bristol	- - - - 36	Dallas	- - - - 95	New York	- - - - 99
		Charlotte	- - - - 40	Dayton	- - - - 42,95	Pittsburgh	- - - - 45,99
		Cincinnati	- - - - 40	Denver	- - - - 95	St. Louis	- - - - 45,99
		Cleveland	- - - - 40	Des Moines	- - - - 43,95	St. Petersburg	- - - 99
		Columbus, Ohio	- - - - 40	Detroit	- - - - 43,96	Tampa	- - - - 100
		Greensboro	- - - - 40	Evansville	- - - - 43,96	Washington, D. C.	- - 45,100
		Huntington	- - - - 40	Ft. Lauderdale	- - - 96		
		Huntsville	- - - - 40,94	Grand Rapids	- - - 43	CLEVELAND	
		Knoxville	- - - - 40	Greensboro	- - - - 96	Akron	- - - - 23
		Lexington	- - - - 40	Harrisburg	- - - - 96	Allentown	- - - - 26,84
		Louisville	- - - - 40	Hartford	- - - - 96	Atlanta	- - - - 86
		New York	- - - - 40,94	Honolulu	- - - - 96	Boston	- - - - 91
		Pittsburgh	- - - - 41	Houston	- - - - 96	Buffalo	- - - - 37
		Roanoke	- - - - 41	Indianapolis	- - - - 43	Charleston, W. Va.	- - 40
				Kansas City	- - - - 43,96	Charlotte	- - - - 41,94

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Chattanooga	- - - - - 41
Chicago	- - - - - 42,95
Cincinnati	- - - - - 44
Columbus, Ohio	- - - - - 45
Dayton	- - - - - 45
Detroit	- - - - - 45
Ft. Wayne	- - - - - 45
Grand Rapids	- - - - - 45
Hartford	- - - - - 100
Indianapolis	- - - - - 45,100
Knoxville	- - - - - 45,100
Los Angeles	- - - - - 100
Miami	- - - - - 100
Milwaukee	- - - - - 45,100
New York	- - - - - 46,100
Philadelphia	- - - - - 46,100
Pittsburgh	- - - - - 46
Rochester, N. Y.	- - - - - 46,100
St. Louis	- - - - - 100
St. Petersburg	- - - - - 101
Tampa	- - - - - 101
Toledo	- - - - - 46
Toronto	- - - - - 46
Washington, D. C.	- - - - - 46,101

CLOVIS

Lubbock	- - - - - 46
Santa Fe	- - - - - 46

COLLEGE STATION

Houston	- - - - - 46
Temple	- - - - - 46

COLORADO SPRINGS

Amarillo	- - - - - 26,84
Denver	- - - - - 46
Oklahoma City	- - - - - 46,101
Pueblo	- - - - - 46

COLUMBIA

Atlanta	- - - - - 28
Charleston, S. C.	- - - - - 39
Charlotte	- - - - - 41,94
Florence	- - - - - 47
Greenville	- - - - - 47
Jacksonville	- - - - - 47,101
Meridian	- - - - - 47,101
Montgomery	- - - - - 47,101
Pensacola	- - - - - 47,101
Raleigh	- - - - - 47
Savannah	- - - - - 47
Washington, O. C.	- - - - - 47,101

COLUMBUS, GA.

Atlanta	- - - - - 28
Montgomery	- - - - - 47
Pensacola	- - - - - 47
Tallahassee	- - - - - 47

COLUMBUS, OHIO

Akron	- - - - - 23
Charleston, W. Va.	- - - - - 40
Charlotte	- - - - - 41,94
Chicago	- - - - - 42,95
Cincinnati	- - - - - 44
Cleveland	- - - - - 45
Dayton	- - - - - 47
Detroit	- - - - - 47
Indianapolis	- - - - - 48
Louisville	- - - - - 48
New York	- - - - - 101
Philadelphia	- - - - - 48,101
Pittsburgh	- - - - - 48

COLUMBUS, OHIO (Continued)

Tampa	- - - - - 101
Toledo	- - - - - 48
Washington, D. C.	- - - - - 48,102

COMOX

Port Hardy	- - - - - 48
Vancouver	- - - - - 48

CONCORD

Boston	- - - - - 35
Fitchburg	- - - - - 48
Laconia	- - - - - 48

CORPUS CHRISTI

Brownsville	- - - - - 36
Houston	- - - - - 48
San Antonio	- - - - - 48

CRANBROOK

Calgary	- - - - - 38
Castlegar	- - - - - 39

DALLAS

Abilene	- - - - - 23
Albuquerque	- - - - - 83
Amarillo	- - - - - 26,84
Atlanta	- - - - - 86
Austin	- - - - - 30
Baltimore	- - - - - 88
Boston	- - - - - 91
Chicago	- - - - - 95
Cincinnati	- - - - - 99
Denver	- - - - - 102
El Paso	- - - - - 102
Ft. Worth	- - - - - 48
Houston	- - - - - 48,102
Jackson	- - - - - 49,102
Kansas City	- - - - - 49,102
Las Vegas	- - - - - 102
Lawton	- - - - - 49
Little Rock	- - - - - 49,102
Los Angeles	- - - - - 102
Louisville	- - - - - 102
Lubbock	- - - - - 49,102
McAlester	- - - - - 49
Memphis	- - - - - 49,102
Miami	- - - - - 103
Midland	- - - - - 49,103
Monroe	- - - - - 49,103
New Orleans	- - - - - 49,103
New York	- - - - - 103
Oklahoma City	- - - - - 49
Orlando	- - - - - 103
St. Louis	- - - - - 103
San Antonio	- - - - - 49,103
San Francisco	- - - - - 103
Seattle	- - - - - 103
Shreveport	- - - - - 49
Tucson	- - - - - 103
Tulsa	- - - - - 49,103
Waco	- - - - - 50
Washington, O. C.	- - - - - 104
Wichita Falls	- - - - - 50

OANVILLE

Charlotte	- - - - - 41
Greensboro	- - - - - 50
Richmond	- - - - - 50

DAYTON

Akron	- - - - - 23
Chicago	- - - - - 42,95
Cincinnati	- - - - - 44

DAYTON (Continued)

Cleveland	- - - - - 45
Columbus, Ohio	- - - - - 47
Ft. Wayne	- - - - - 50
Hartford	- - - - - 104
Indianapolis	- - - - - 50
Los Angeles	- - - - - 104
New York	- - - - - 104
Pittsburgh	- - - - - 50
St. Louis	- - - - - 50,104
Washington, O. C.	- - - - - 50,104

DAYTONA BEACH

Jacksonville	- - - - - 50
Lakeland	- - - - - 50
Melbourne	- - - - - 50
Miami	- - - - - 50,104
Orlando	- - - - - 50
Tampa	- - - - - 51
West Palm Beach	- - - - - 51

DENVER

Albuquerque	- - - - - 25,83
Amarillo	- - - - - 26,84
Baltimore	- - - - - 89
Boise	- - - - - 91
Boston	- - - - - 91
Casper	- - - - - 39,93
Cheyenne	- - - - - 42
Chicago	- - - - - 95
Colorado Springs	- - - - - 46
Dallas	- - - - - 102
El Paso	- - - - - 104
Grand Junction	- - - - - 51
Kansas City	- - - - - 104
Las Vegas	- - - - - 104
Lincoln	- - - - - 51,104
Los Angeles	- - - - - 104
Lubbock	- - - - - 51,105
Milwaukee	- - - - - 105
Minneapolis	- - - - - 105
New York	- - - - - 105
Omaha	- - - - - 51,105
Phoenix	- - - - - 105
Portland, Ore.	- - - - - 105
Rapid City	- - - - - 51,105
Reno	- - - - - 105
Salt Lake City	- - - - - 51,105
San Francisco	- - - - - 105
Seattle	- - - - - 105
Sioux Falls	- - - - - 106
Tulsa	- - - - - 106
Washington, O. C.	- - - - - 106
Wichita	- - - - - 51,106

DES MOINES

Cedar Rapids	- - - - - 39
Chicago	- - - - - 43,95
Kansas City	- - - - - 51
Los Angeles	- - - - - 106
Minneapolis	- - - - - 51,106
Omaha	- - - - - 51
St. Louis	- - - - - 51,106
Waterloo	- - - - - 51

DETROIT

Akron	- - - - - 23
Atlanta	- - - - - 86
Baltimore	- - - - - 31,89
Boston	- - - - - 92
Buffalo	- - - - - 37,92
Chicago	- - - - - 43,96
Cincinnati	- - - - - 44,99
Cleveland	- - - - - 45

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Columbus, Ohio	- - - - - 47
Flint	- - - - - 52
Grand Rapids	- - - - - 52
Indianapolis	- - - - - 52,106
Land O'Lakes	- - - - - 52,106
Lansing	- - - - - 52
Las Vegas	- - - - - 106
Los Angeles	- - - - - 106
Louisville	- - - - - 52,106
Miami	- - - - - 107
Milwaukee	- - - - - 52,107
Minneapolis	- - - - - 107
New York	- - - - - 107
Omaha	- - - - - 107
Philadelphia	- - - - - 52,107
Pittsburgh	- - - - - 52
Rochester, N. Y.	- - - - - 52,107
St. Louis	- - - - - 52,107
St. Petersburg	- - - - - 107
San Francisco	- - - - - 107
Toledo	- - - - - 52
Washington, O. C.	- - - - - 52,107

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Anchorage	- - - - - 85
Calgary	- - - - - 38
Grand Prairie	- - - - - 53,107
Minneapolis	- - - - - 108
Montreal	- - - - - 108
Regina	- - - - - 53,108
Saskatoon	- - - - - 53,108
Toronto	- - - - - 108
Vancouver	- - - - - 108
Winnipeg	- - - - - 108

ELKO

Ely	- - - - - 53
Reno	- - - - - 53

ELMIRA

Buffalo	- - - - - 37
Rochester, N. Y.	- - - - - 53
Williamsport	- - - - - 53

EL PASO

Abilene	- - - - - 23,83
Alamogordo	- - - - - 24
Albuquerque	- - - - - 25
Bisbee	- - - - - 34
Carlsbad	- - - - - 38
Dallas	- - - - - 102
Denver	- - - - - 104
Ft. Worth	- - - - - 108
Houston	- - - - - 108
Los Angeles	- - - - - 108
Midland	- - - - - 53,108
Phoenix	- - - - - 53,108
Roswell	- - - - - 53
San Antonio	- - - - - 109
San Diego	- - - - - 109
San Francisco	- - - - - 109
Tucson	- - - - - 53,109

ELY

Elko	- - - - - 53
Salt Lake City	- - - - - 53

EUGENE

Medford	- - - - - 53
Salem	- - - - - 53

EVANSVILLE
Chicago - - - - - 43,96
Indianapolis - - - - - 54
Louisville - - - - - 54
Nashville - - - - - 54
Owensboro - - - - - 54
Paducah - - - - - 54
St. Louis - - - - - 54

FAIRBANKS
Anchorage - - - - - 85
Juneau - - - - - 109
San Francisco - - - - - 109
Seattle - - - - - 109
Whitehorse - - - - - 109

FARGO
Bismark - - - - - 34
Grand Forks - - - - - 54
Jamestown - - - - - 54
Minneapolis - - - - - 54
Winnipeg - - - - - 54

FAYETTEVILLE
New Bern - - - - - 109
Wilmington, N. C. - - 109

FITCHBURG
Boston - - - - - 35
Concord - - - - - 48

FLINT
Detroit - - - - - 52
Grand Rapids - - - - - 54
New York - - - - - 109
Saginaw - - - - - 54

FLORENCE
Charleston, S. C. - - 39
Columbia - - - - - 47
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Kansas City	- 63
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Palm Springs	- 73
San Francisco	- 73,123

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Cleveland	- 46,100
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Miami	- 119
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New York	- 71
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Indianapolis	- 61,114
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Knoxville	- 64,115
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Miami	- 119
New York	- 71,122
Philadelphia	- 74,123
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Chicago - - - - -	98	Pittsburgh - - - - -	75	Dallas - - - - -	103	Los Angeles - - - - -	66
Hartford - - - - -	59	Washington, D. C. - -	77	Dayton - - - - -	50,104	Palm Springs - - - - -	74
New York - - - - -	71	Winston-Salem - - - -	77	Des Moines - - - - -	51,106	Phoenix - - - - -	74,124
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Santa Fe - - - - -	76	Madison - - - - -	67	Indianapolis - - - -	61	Prince Rupert - - - -	76
		Minneapolis - - - -	69	Kansas City - - - - -	63	Vancouver - - - - -	126
		Waterloo - - - - -	77	Little Rock - - - - -	65,116		
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Seven Islands - - - -	76,125	Chicago - - - - -	44,98	Nashville - - - - -	71,121	Boise - - - - -	91
		Cleveland - - - - -	46,100	New York - - - - -	122	Boston - - - - -	92
QUESNEL		Detroit - - - - -	52,107	Oklahoma City - - - -	123	Burbank - - - - -	37,93
Prince George - - - -	76	Elmira - - - - -	53	Philadelphia - - - - -	124	Chicago - - - - -	98
William Lake - - - - -	76	New York - - - - -	72,122	San Francisco - - - -	125	Dallas - - - - -	103
		Philadelphia - - - -	74,124	Springfield, Mo. - - -	78	Denver - - - - -	105
RALEIGH		Syracuse - - - - -	77	Tampa - - - - -	125	Detroit - - - - -	107
Atlanta - - - - -	29,87	Washington, D. C. - -	77,125	Tulsa - - - - -	78,126	El Paso - - - - -	109
Charlotte - - - - -	41			Washington, D. C. - -	126	Fairbanks - - - - -	109
Columbia - - - - -	47	ROCKLAND				Fresno - - - - -	56
Florence - - - - -	54	Augusta, Me. - - - -	30	ST. PETERSBURG		Honolulu - - - - -	112
Greensboro - - - - -	58			Atlanta - - - - -	29,88	Houston - - - - -	113
New York - - - - -	71,122	ROME		Cincinnati - - - - -	99	Las Vegas - - - - -	65,116
Pittsburgh - - - - -	75,124	Atlanta - - - - -	29	Cleveland - - - - -	101	Los Angeles - - - - -	66,117
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		ROSWELL		Miami - - - - -	68	Monterey - - - - -	70
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Casper - - - - -	39	El Paso - - - - -	53	Pittsburgh - - - - -	124	Oakland - - - - -	73
Denver - - - - -	51,105	Hobbs - - - - -	60	Washington, D. C. - -	126	Ontario - - - - -	73,123
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Harrisburg - - - - -	59	SACRAMENTO		SALINAS		St. Louis - - - - -	125
Lancaster - - - - -	64	Las Vegas - - - - -	64,116	Monterey - - - - -	70	Salinas - - - - -	78
New York - - - - -	72	Los Angeles - - - - -	66,117	San Francisco - - - -	78	Salt Lake City - - - -	126
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Calgary - - - - -	38,93	Stockton - - - - -	78	Boise - - - - -	35,91	Washington, D. C. - -	126
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Elko - - - - -	53	Quebec - - - - -	76	Minneapolis - - - - -	120	Salinas - - - - -	78
Oakland - - - - -	73	Seven Islands - - - -	78,125	Oakland - - - - -	123		
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San Francisco - - - -	77	Halifax - - - - -	59	San Francisco - - - - -	126	Pueblo - - - - -	76
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		Montreal - - - - -	70,121	SAN ANGELO		SARASOTA	
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Arctic

Ocean

SOV.
UN.

Bering

Sea

A L A S K A

C A N A D A

FAIRBANKS

DAVIS CITY

MAYO

ANCHORAGE

BIG MOUNTAIN

KING SALMON

Bristol Bay

KODIAK

SEWARD

SIKOTUVA

WHEAT RIVER

VALDEZ

BARROW

WILKES

ELIZABETH

BARNEZ

WATSON LAKE

FT. NELSON

TO NEW YORK

TO MINNEAPOLIS

TO EDMONTON

Pacific

Ocean

PRINCE RUPERT

SKAGWAY

TO VANCOUVER

TO SEATTLE

TO PORTLAND

TO OREGON

TO CALIFORNIA

TO TEXAS

TO FLORIDA

TO MISSISSIPPI

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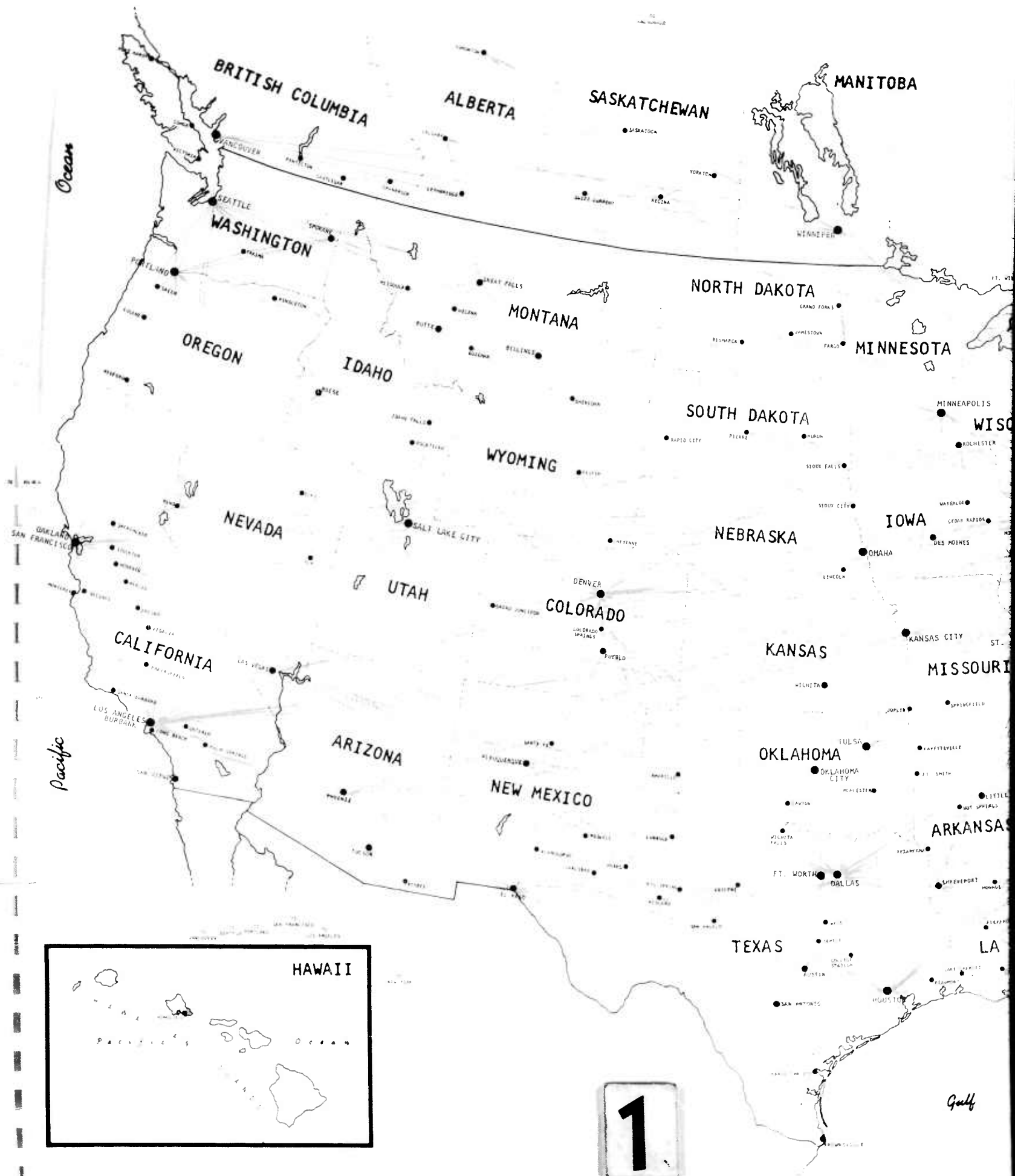
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