

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington D.C. 20594

Meteorological Factual Report
DCA02MA001

A. ACCIDENT

Location: Belle Harbor, New York
Date: November 12, 2001
Time: About 1416 Coordinated Universal Time (UTC)
Aircraft: Aircraft Airbus Industrie A-300-600, N14053, Operated as American Airlines Flight 587 (AAL 587)

B. WEATHER GROUP

Chairman: Gregory D. Salottolo, National Transportation Safety Board, Washington D.C.

Member: Warren Qualley, American Airlines Manager of Weather Services, Fort Worth, Texas.

Member: Tim Miner, Allied Pilots Association.

Tim Miner was not present during the on-scene portion of the investigation.

C. SUMMARY

On November 12, 2001, about 1416 UTC (0916 Eastern Standard Time), American Airlines flight 587, an Airbus A300-600, was destroyed when it crashed into a residential area of Belle Harbor, New York, shortly after takeoff from the John F. Kennedy International Airport (JFK), Jamaica, New York. Two pilots, 7 flight attendants, 251 passengers, and 5 persons on the ground were fatally injured. Visual meteorological conditions prevailed and an instrument flight rules flight plan had been filed for the flight destined for Santo Domingo, Dominican Republic. The scheduled passenger flight was conducted under 14 CFR Part 121.

D. DETAILS OF INVESTIGATION

Note: All times are stated as Coordinated Universal Time (UTC) based on the 24-hour clock unless otherwise noted. All heights above mean sea level (MSL) unless noted. Heights in surface weather observations and terminal forecast above ground level (AGL). All directions with reference to true north unless noted. All distances in statute miles unless noted. Z = UTC.

McIDAS - **Man** computer **I**nteractive **D**ata **A**ccess **S**ystem. McIDAS is an interactive meteorological analysis and data management computer system. McIDAS is administered by personnel at the Space Science and Engineering Center at the University of Wisconsin at Madison. Data are accessed and reviewed on a Hewlett Packard 9000/C110 Workstation running McIDAS-X software.

Surface Weather Observations

John F. Kennedy International Airport, New York (KJFK)

An Automated Surface Observing System (ASOS) is installed at KJFK. The ASOS is augmented and edited by a private contractor weather observer.

1351Z ... METAR (Aviation Routine Weather Report) ... Winds 310 degrees at 11 knots; visibility 10 miles; few clouds at 4,300 feet; temperature 6 degrees C; dew point -6 degrees C; altimeter setting 30.44 inches of Hg.

1425Z ... SPECI (Special Weather Report) ... Winds 270 degrees at 8 knots; visibility 10 miles; few clouds at 4,800 feet; temperature 6 degrees C; dew point -6 degrees C; altimeter setting 30.44 inches of Hg.; aircraft mishap*; smoke plume south.

* This remark was not transmitted long-line.

5-minute ASOS data ...

1400Z ... Winds 310 at 10 knots; visibility 10 miles; clear skies (no clouds at or below 12,000 feet); temperature 6 degrees C; dew point -6 degrees C; altimeter setting 30.44 inches of Hg.; pressure altitude -460 feet.

1405Z ... Winds 290 degrees at 10 knots; visibility 10 miles; clear skies; temperature 6 degrees C; dew point -6 degrees C; altimeter setting 30.44 inches of Hg.; pressure altitude -460 feet.

1410Z ... Winds 310 degrees at 11 knots; visibility 10 miles; clear skies; temperature 6 degrees C; dew point -6 degrees C; altimeter setting 30.44 inches of Hg.; pressure altitude -460 feet.

1415Z ... Winds 280 degrees at 8 knots; visibility 10 miles; clear skies; temperature 6 degrees C; dew point -6 degrees C; altimeter setting 30.44 inches of Hg.; pressure altitude -460 feet.

1420Z ... Winds 280 degrees at 7 knots; visibility 10 miles; clear skies; temperature 7 degrees C; dew point -6 degrees C; altimeter setting 30.44 inches of Hg.; pressure altitude -460 feet.

1425Z ... Winds 270 degrees at 8 knots; visibility 10 miles; few clouds at 4,800 feet; temperature 6 degrees C; dew point -6 degrees C; altimeter setting 30.44 inches of Hg.; pressure altitude -460 feet.

Observations for KJFK ...

MTRJFK METAR KJFK 121551Z 29013G19KT 10SM FEW055 08/M04

A3042 RMK AO2 SLP302 T00831039

MTRJFK METAR KJFK 121451Z 29008KT 10SM FEW055 07/M06 A3044

RMK AO2 SLP306 FU PLUME S DRFTG E T00721061 50008

MTRJFK SPECI KJFK 121425Z 27008KT 10SM FEW048 06/M06 A3044

RMK AO2 FU PLUME S

MTRJFK METAR KJFK 121351Z 31011KT 10SM FEW043 06/M06 A3044

RMK AO2 SLP308 T00561056

MTRJFK METAR KJFK 121251Z 31012KT 10SM FEW034 04/M06 A3043

RMK AO2 SLP305 T00391056

Observations for LaGuardia Airport, New York (KLGA) ...

MTRLGA METAR KLGA 121551Z 32017G23KT 10SM FEW055 08/M02

A3041 RMK AO2 SLP297 T00781022

MTRLGA METAR KLGA 121451Z 32014KT 10SM FEW055 07/M04 A3042

RMK AO2 SLP301 T00671044 50009

MTRLGA METAR KLGA 121351Z 29008KT 10SM CLR 04/M06 A3043 RMK

AO2 SLP303 T00441056

MTRLGA METAR KLGA 121251Z 31014KT 10SM FEW045 04/M05 A3042

RMK AO2 SLP301 T00391050

Observations for Farmingdale, New York (KFRG) ...

KFRG 121553Z 31009G17KT 10SM CLR 08/M05 A3040 RMK AO2 SLP294

T00781050=

KFRG 121453Z 30013G17KT 10SM CLR 07/M06 A3041 RMK AO2 SLP298

T00671061 50006=

KFRG 121353Z 29010KT 10SM CLR 04/M05 A3041 RMK AO2 SLP299

T00441050=

KFRG 121253Z 28006KT 10SM CLR 02/M05 A3040 RMK AO2 SLP296

T00221050=

Upper Air Data

Upton, New York (72501)

Upton is located about 44 nautical miles east of JFK

Data from McIDAS

November 12, 2001 --- 1200Z

Temp ... Temperature degrees C
Dew Point ... Dew Point degrees C
Dir ... Wind Direction degrees true
Speed ... Wind Speed knots
Mix ... Mixing Ratio grams per kilogram

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SOUNDING # 1 IDN= 72501 DAY=2001316 TIME=120000 VALID LEVELS= 63

| Idn | Id | Station Name | St | Co | Lat | Lon | Elev |
|-------|----|--------------|----|----|--------|---------|------|
| 72501 | | Upton | NY | US | 40:52N | 072:52W | 20 |

| Level Type | Pressure [MB] | Temp [C] | Dew Point [C] | Dir [deg] | Speed [KTS] | Height [FT] | Theta [K] | Mix [g/kg] |
|------------|---------------|----------|---------------|-----------|-------------|-------------|-----------|------------|
| SFC | 1026.0 | -3.5 | -6.1 | .0 | .0 | 65.6 | 267.7 | 2.359 |
| SIGT | 1009.0 | 2.0 | -5.0 | 324.3 | 6.4 | 503.8 | 274.5 | 2.609 |
| MAND | 1000.0 | 1.6 | -5.4 | 305.0 | 9.9 | 741.0 | 274.8 | 2.554 |
| SIGW | 990.2 | .9 | -5.7 | 315.0 | 15.9 | 997.4 | 274.8 | 2.516 |
| SIGW | 953.1 | -2.0 | -7.0 | 325.0 | 17.9 | 1998.0 | 274.9 | 2.370 |
| MAND | 925.0 | -4.3 | -8.0 | 335.0 | 18.8 | 2781.0 | 274.9 | 2.260 |
| SIGW | 917.2 | -4.8 | -8.5 | 335.0 | 18.8 | 2998.7 | 275.1 | 2.183 |
| SIGT | 897.0 | -6.1 | -10.0 | 340.7 | 21.7 | 3573.8 | 275.5 | 1.991 |
| SIGT | 883.0 | -3.7 | -15.7 | 344.8 | 23.8 | 3979.9 | 279.2 | 1.273 |
| SIGW | 882.3 | -3.7 | -15.7 | 345.0 | 23.9 | 3999.3 | 279.2 | 1.273 |

| | | | | | | | | |
|------|-------|-------|-------|-------|-------|---------|-------|-------|
| MAND | 850.0 | -5.7 | -15.7 | 345.0 | 26.8 | 4963.6 | 280.2 | 1.322 |
| SIGW | 816.2 | -8.2 | -17.6 | 340.0 | 30.9 | 6000.7 | 280.8 | 1.176 |
| SIGT | 800.0 | -9.5 | -18.5 | 329.8 | 31.4 | 6512.3 | 281.0 | 1.110 |
| SIGW | 784.7 | -9.5 | -20.5 | 320.0 | 31.9 | 7001.3 | 282.6 | .952 |
| SIGW | 754.4 | -9.5 | -24.6 | 300.0 | 39.8 | 8002.0 | 285.8 | .689 |
| SIGT | 748.0 | -9.5 | -25.5 | 300.0 | 40.9 | 8216.7 | 286.5 | .642 |
| SIGT | 740.0 | -8.7 | -36.7 | 300.0 | 42.3 | 8489.7 | 288.2 | .223 |
| SIGW | 725.3 | -9.1 | -40.7 | 300.0 | 44.9 | 8999.3 | 289.5 | .151 |
| MAND | 700.0 | -9.7 | -47.7 | 305.0 | 50.9 | 9899.9 | 291.8 | .073 |
| SIGT | 680.0 | -8.7 | -42.7 | 305.0 | 54.3 | 10635.4 | 295.3 | .130 |
| SIGW | 670.2 | -9.4 | -42.2 | 305.0 | 55.9 | 11000.7 | 295.7 | .139 |
| SIGW | 644.2 | -11.4 | -40.9 | 300.0 | 59.8 | 12001.3 | 296.9 | .166 |
| SIGT | 625.0 | -12.9 | -39.9 | 300.0 | 61.4 | 12762.8 | 297.7 | .190 |
| SIGT | 610.0 | -12.5 | -40.5 | 300.0 | 62.6 | 13371.1 | 300.2 | .183 |
| SIGW | 594.7 | -13.9 | -36.2 | 300.0 | 63.9 | 14002.6 | 300.9 | .293 |
| SIGT | 568.0 | -16.3 | -28.3 | 302.9 | 66.7 | 15146.0 | 302.0 | .654 |
| SIGW | 548.4 | -17.9 | -29.6 | 305.0 | 68.8 | 16003.9 | 303.1 | .603 |
| SIGT | 508.0 | -21.3 | -32.3 | 300.9 | 72.2 | 17876.7 | 305.7 | .501 |
| MAND | 500.0 | -22.1 | -31.1 | 300.0 | 72.8 | 18260.5 | 306.1 | .571 |
| SIGW | 464.9 | -26.2 | -32.3 | 300.0 | 77.9 | 20003.3 | 307.5 | .549 |
| SIGT | 464.0 | -26.3 | -32.3 | 300.1 | 77.9 | 20049.4 | 307.5 | .549 |
| MAND | 400.0 | -34.1 | -44.1 | 305.0 | 77.9 | 23516.6 | 310.7 | .189 |
| SIGW | 374.7 | -37.4 | -50.0 | 305.0 | 79.8 | 25003.3 | 312.2 | .108 |
| SIGT | 361.0 | -39.3 | -53.3 | 305.0 | 84.9 | 25848.6 | 313.0 | .081 |
| SIGW | 342.5 | -42.4 | -55.2 | 305.0 | 91.9 | 27004.6 | 313.5 | .067 |
| MAXW | 341.0 | -42.6 | -55.4 | 305.0 | 91.9 | 27100.4 | 313.6 | .067 |
| MAND | 300.0 | -50.1 | -60.1 | 302.9 | 91.5 | 29913.8 | 314.7 | .046 |
| MAND | 250.0 | -58.5 | -66.5 | 300.0 | 90.9 | 33749.7 | 319.1 | ----- |
| SIGW | 235.3 | -57.6 | -66.6 | 300.0 | 89.7 | 35006.6 | 326.0 | ----- |
| SIGT | 209.0 | -55.9 | -66.9 | 289.1 | 75.3 | 37468.3 | 340.0 | ----- |
| MAND | 200.0 | -57.7 | -70.7 | 285.0 | 69.9 | 38383.8 | 341.4 | ----- |
| SIGT | 194.0 | -58.3 | -71.3 | 286.9 | 66.4 | 39013.8 | 343.4 | ----- |
| SIGW | 184.9 | -55.2 | -69.8 | 290.0 | 60.8 | 40009.8 | 353.2 | ----- |
| SIGT | 183.0 | -54.5 | -69.5 | 289.6 | 61.7 | 40230.1 | 355.4 | ----- |
| SIGT | 161.0 | -54.5 | -74.5 | 285.1 | 72.5 | 42922.3 | 368.7 | ----- |
| SIGW | 160.3 | -54.6 | -74.6 | 285.0 | 72.8 | 43008.5 | 368.9 | ----- |
| MAND | 150.0 | -56.9 | -76.9 | 280.0 | 71.9 | 44401.6 | 372.1 | ----- |
| SIGW | 126.0 | -58.1 | -78.7 | 290.0 | 60.8 | 48011.8 | 389.0 | ----- |
| SIGT | 115.0 | -58.7 | -79.7 | 280.5 | 52.3 | 49902.3 | 398.1 | ----- |
| SIGW | 114.4 | -58.6 | -79.7 | 280.0 | 51.9 | 50009.8 | 398.8 | ----- |
| MAND | 100.0 | -57.3 | -79.3 | 275.0 | 45.8 | 52793.0 | 417.0 | ----- |
| SIGT | 94.4 | -57.3 | -79.3 | 276.6 | 45.4 | 53988.8 | 424.0 | ----- |
| SIGT | 80.3 | -61.5 | -82.5 | 281.2 | 44.0 | 57313.0 | 435.4 | ----- |
| MAND | 70.0 | -58.9 | -80.9 | 285.0 | 42.9 | 60123.2 | 458.4 | ----- |
| SIGT | 60.7 | -56.7 | -80.7 | 280.8 | 35.3 | 63074.3 | 482.4 | ----- |
| SIGT | 52.3 | -59.3 | -82.3 | 276.3 | 27.3 | 66155.0 | 497.3 | ----- |
| MAND | 50.0 | -58.1 | -81.1 | 275.0 | 24.9 | 67082.2 | 506.6 | ----- |
| SIGT | 43.4 | -55.3 | -79.3 | 275.0 | 25.7 | 70027.8 | 534.4 | ----- |
| SIGT | 36.3 | -58.5 | -81.5 | 275.0 | 26.8 | 73741.6 | 554.1 | ----- |
| MAND | 30.0 | -56.1 | -80.1 | 275.0 | 28.0 | 77697.0 | 591.7 | ----- |
| SIGT | 20.8 | -54.7 | -78.7 | 266.0 | 26.0 | 85363.6 | 661.3 | ----- |
| MAND | 20.0 | -55.7 | -79.7 | 265.0 | 25.8 | 86185.3 | 665.7 | ----- |
| SIGT | 17.4 | -56.7 | -80.7 | ----- | ----- | 89089.8 | 689.6 | ----- |

Parcel Definition for 100 mb Boundary Layer: 1200 UTC 12 Nov 2001316

Dewpoint Temperature (TD) = -6.3 C
 Potential Temperature (Th) = 274.2 K
 Equivalent Potential Temperature (ThE) = 280.5 K
 Mixing Ratio (MIX) = 2.4 g/kg

Stability Indices and Levels:

Lifted Condensation Level (LCL) = 898 mb
 Temperature at LCL (TLCL) = -7.3 C
 Level of Free Convection (LFC) = -----
 Equilibrium Level (EL) = -----
 Convective Temperature (CVT) = -----
 Forecast Maximum Temperature (FMAX) = 5.8 C

 K Index (KI) = -37.3
 Lifted Index (LI) = 21.4
 Severe Weather Threat Index (SwI) = 126.6
 Showalter Index (ShI) = 18.8
 Total Totals Index (TTI) = 22.8

 Precipitable Water (PW) = 5.5 mm

Energy Analysis:

Helicity (HELI) = -136 m**2/s**2
 Convective Available Potential Energy (CAPE) = -----
 Convective Inhibition (CIN) = -----

 Theta-E for Forecast Maximum Temperature = 283 K
 CAPE for Forecast Maximum Temperature = -----

 Maximum Theta-E at or below 300 mb = 314 K
 Pressure Level of Maximum Theta-E = 341 mb
 CAPE for Maximum Theta-E = -----

November 13, 2001 --- 0000Z

SOUNDING # 1 IDN= 72501 DAY=2001317 TIME= 0 VALID LEVELS= 59

Idn Id Station Name St Co Lat Lon Elev
 72501 Upton NY US 40:52N 072:52W 20

| Level Type | Pressure [MB] | Temp [C] | Dew Point [C] | Dir [deg] | Speed [KTS] | Height [FT] | Theta [K] | Mix [g/kg] |
|------------|---------------|----------|---------------|-----------|-------------|-------------|-----------|------------|
| SFC | 1029.0 | 3.8 | -7.2 | 330.0 | 2.9 | 65.6 | 274.7 | 2.161 |
| SIGT | 1023.0 | 5.6 | -6.4 | 331.0 | 4.9 | 222.0 | 277.0 | 2.312 |
| MAND | 1000.0 | 5.2 | -6.8 | 335.0 | 12.8 | 831.8 | 278.4 | 2.294 |
| SIGW | 993.8 | 4.7 | -7.0 | 335.0 | 15.9 | 997.4 | 278.4 | 2.278 |
| SIGW | 956.9 | 1.8 | -8.0 | 330.0 | 17.9 | 1998.0 | 278.4 | 2.186 |
| MAND | 925.0 | -.9 | -8.9 | 325.0 | 18.8 | 2897.8 | 278.4 | 2.106 |

| | | | | | | | | |
|------|-------|-------|-------|-------|-------|---------|-------|-------|
| SIGW | 921.4 | -1.2 | -9.0 | 325.0 | 18.8 | 2998.7 | 278.4 | 2.092 |
| SIGW | 886.7 | -4.2 | -10.4 | 320.0 | 17.9 | 3999.3 | 278.4 | 1.958 |
| SIGT | 883.0 | -4.5 | -10.5 | 320.0 | 18.0 | 4107.4 | 278.4 | 1.944 |
| SIGW | 852.9 | -6.5 | -16.1 | 320.0 | 18.8 | 5000.0 | 279.1 | 1.270 |
| MAND | 850.0 | -6.7 | -16.7 | 325.0 | 19.8 | 5088.0 | 279.1 | 1.216 |
| SIGT | 840.0 | -7.3 | -18.3 | 330.0 | 21.8 | 5391.0 | 279.5 | 1.075 |
| SIGT | 827.0 | -6.9 | -34.9 | 336.5 | 24.4 | 5790.1 | 281.1 | .239 |
| SIGW | 820.2 | -6.9 | -36.1 | 340.0 | 25.8 | 6000.7 | 281.8 | .215 |
| SIGW | 788.8 | -7.1 | -41.6 | 340.0 | 28.9 | 7001.3 | 284.7 | .126 |
| SIGW | 758.5 | -7.3 | -47.1 | 330.0 | 33.8 | 8002.0 | 287.8 | .072 |
| SIGT | 752.0 | -7.3 | -48.3 | 328.9 | 34.7 | 8221.8 | 288.4 | .064 |
| SIGW | 729.5 | -6.7 | -34.2 | 325.0 | 37.9 | 8999.3 | 291.6 | .289 |
| SIGT | 714.0 | -6.3 | -24.3 | 322.2 | 39.5 | 9549.8 | 293.9 | .749 |
| SIGW | 701.6 | -7.0 | -21.5 | 320.0 | 40.8 | 10000.0 | 294.5 | .980 |
| MAND | 700.0 | -7.1 | -21.1 | 320.0 | 40.8 | 10057.3 | 294.6 | 1.014 |
| SIGT | 656.0 | -9.1 | -21.1 | 320.0 | 46.7 | 11712.5 | 297.9 | 1.082 |
| SIGW | 648.5 | -9.7 | -21.4 | 320.0 | 47.8 | 12001.3 | 298.3 | 1.066 |
| SIGW | 598.5 | -13.5 | -23.5 | 320.0 | 51.9 | 14002.6 | 300.8 | .958 |
| SIGW | 552.4 | -17.3 | -25.6 | 315.0 | 54.8 | 16003.9 | 303.2 | .858 |
| SIGT | 543.0 | -18.1 | -26.1 | 315.0 | 55.7 | 16432.3 | 303.7 | .837 |
| MAND | 500.0 | -21.5 | -32.5 | 315.0 | 59.8 | 18442.5 | 306.8 | .500 |
| SIGW | 468.4 | -25.0 | -33.5 | 310.0 | 63.9 | 20003.3 | 308.3 | .485 |
| SIGT | 450.0 | -27.1 | -34.1 | 310.0 | 69.7 | 20963.7 | 309.2 | .475 |
| SIGW | 449.2 | -27.2 | -34.2 | 310.0 | 69.9 | 21003.9 | 309.2 | .470 |
| MAND | 400.0 | -33.1 | -43.1 | 305.0 | 64.9 | 23716.3 | 312.0 | .211 |
| SIGW | 378.1 | -35.7 | -47.8 | 300.0 | 67.8 | 25003.3 | 313.6 | .134 |
| SIGT | 359.0 | -38.1 | -52.1 | 301.2 | 69.4 | 26186.1 | 315.1 | .093 |
| SIGW | 302.0 | -48.3 | -59.4 | 305.0 | 74.8 | 30006.6 | 316.7 | .050 |
| MAND | 300.0 | -48.7 | -59.7 | 305.0 | 75.8 | 30151.7 | 316.7 | .048 |
| MAND | 250.0 | -58.5 | -66.5 | 300.0 | 72.8 | 33999.8 | 319.1 | ----- |
| SIGW | 238.0 | -60.2 | -67.6 | 295.0 | 72.8 | 35006.6 | 321.0 | ----- |
| TRO1 | 232.0 | -61.1 | -68.1 | 295.0 | 73.8 | 35532.4 | 322.1 | ----- |
| MAND | 200.0 | -59.9 | -68.9 | 295.0 | 75.8 | 38566.5 | 337.9 | ----- |
| SIGW | 186.4 | -59.9 | -69.6 | 290.0 | 78.9 | 40009.8 | 344.8 | ----- |
| MAXW | 183.0 | -59.9 | -69.7 | 290.0 | 78.9 | 40387.6 | 346.6 | ----- |
| SIGT | 180.0 | -59.9 | -69.9 | 290.0 | 76.4 | 40726.5 | 348.3 | ----- |
| SIGT | 173.0 | -56.3 | -68.3 | 290.0 | 70.4 | 41546.5 | 358.2 | ----- |
| SIGW | 161.2 | -57.7 | -71.7 | 290.0 | 59.8 | 43008.5 | 363.1 | ----- |
| MAND | 150.0 | -59.1 | -75.1 | 290.0 | 57.9 | 44501.1 | 368.3 | ----- |
| SIGW | 114.7 | -59.8 | -78.4 | 290.0 | 56.9 | 50009.8 | 396.4 | ----- |
| MAND | 100.0 | -60.1 | -80.1 | 285.0 | 49.0 | 52825.0 | 411.6 | ----- |
| SIGT | 95.2 | -59.5 | -80.5 | 283.6 | 48.0 | 53833.9 | 418.6 | ----- |
| SIGT | 81.0 | -58.7 | -80.7 | 279.1 | 44.8 | 57157.8 | 440.1 | ----- |
| SIGT | 71.2 | -61.7 | -82.7 | 275.5 | 42.3 | 59797.7 | 450.2 | ----- |
| MAND | 70.0 | -60.1 | -83.1 | 275.0 | 42.0 | 60144.5 | 455.8 | ----- |
| SIGT | 66.8 | -57.9 | -80.9 | 277.1 | 40.2 | 61107.8 | 466.7 | ----- |
| MAND | 50.0 | -58.3 | -81.3 | 290.0 | 28.9 | 67096.5 | 506.1 | ----- |
| SIGT | 38.9 | -60.1 | -83.1 | 280.2 | 26.5 | 72259.6 | 539.2 | ----- |
| SIGT | 36.0 | -57.9 | -82.9 | 277.2 | 25.7 | 73854.6 | 557.0 | ----- |
| MAND | 30.0 | -54.7 | -80.7 | 270.0 | 23.9 | 77655.3 | 595.5 | ----- |
| MAND | 20.0 | -56.3 | -81.3 | 270.0 | 35.9 | 86139.0 | 663.9 | ----- |
| SIGT | 16.0 | -52.9 | -78.9 | ----- | ----- | 90827.2 | 718.7 | ----- |
| SIGT | 11.7 | -53.1 | -79.1 | ----- | ----- | 97451.5 | 785.3 | ----- |

Parcel Definition for 100 mb Boundary Layer: 0000 UTC 13 Nov 2001317

| | | |
|--|---|----------|
| Dewpoint Temperature (TD) | = | -7.5 C |
| Potential Temperature (Th) | = | 278.1 K |
| Equivalent Potential Temperature (ThE) | = | 284.0 K |
| Mixing Ratio (MIX) | = | 2.2 g/kg |

Stability Indices and Levels:

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-----
Lifted Condensation Level (LCL)           =      833 mb
Temperature at LCL (TLCL)                =      -9.3 C
Level of Free Convection (LFC)           =      -----
Equilibrium Level (EL)                   =      -----
Convective Temperature (CVT)             =      -----
Forecast Maximum Temperature (FMAX)      =      9.5 C

K Index (KI)                             =     -15.9
Lifted Index (LI)                        =      19.4
Severe Weather Threat Index (SwI)       =      99.5
Showalter Index (ShI)                    =      20.5
Total Totals Index (TTI)                 =      19.6

Precipitable Water (PW)                  =      6.1 mm

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Energy Analysis:

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Helicity (HELI)                          =     -223 m**2/s**2
Convective Available Potential Energy (CAPE) =      -----
Convective Inhibition (CIN)              =      -----

Theta-E for Forecast Maximum Temperature =      286 K
CAPE for Forecast Maximum Temperature    =      -----

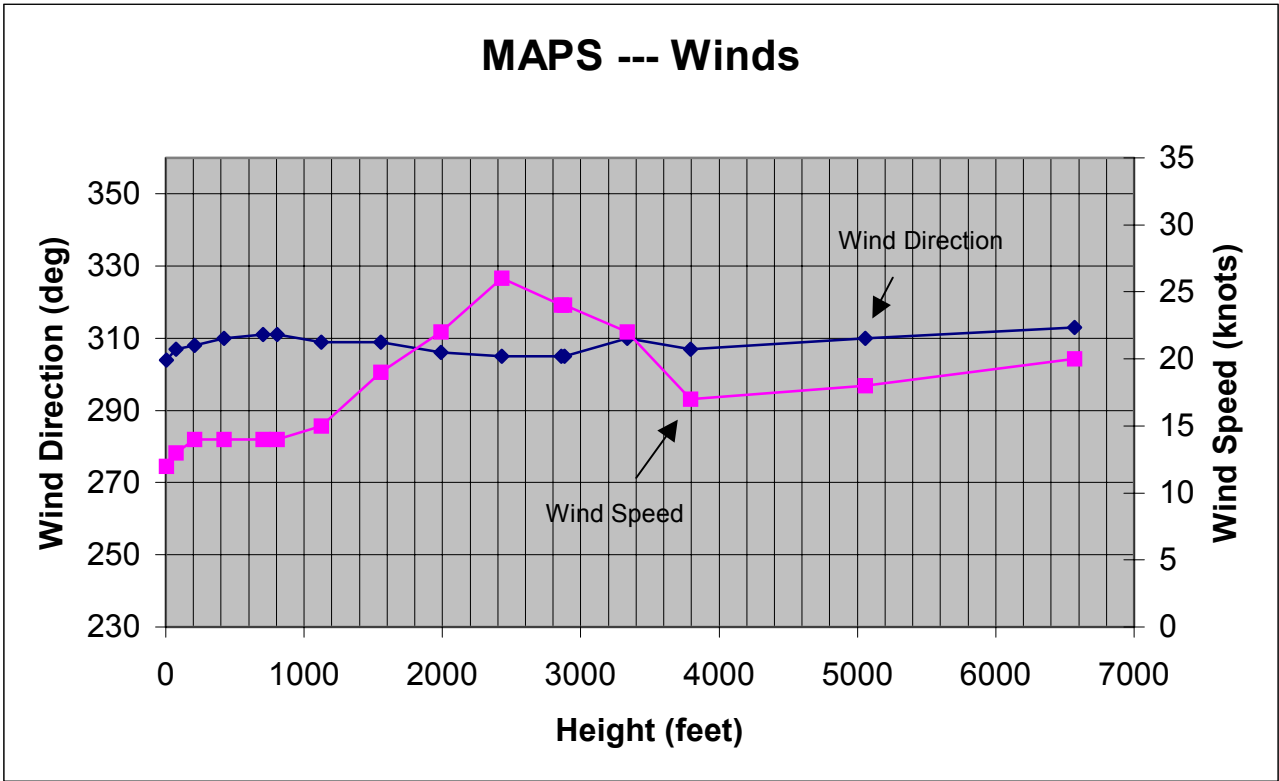
Maximum Theta-E at or below 300 mb      =      317 K
Pressure Level of Maximum Theta-E       =      302 mb
CAPE for Maximum Theta-E                 =      -----

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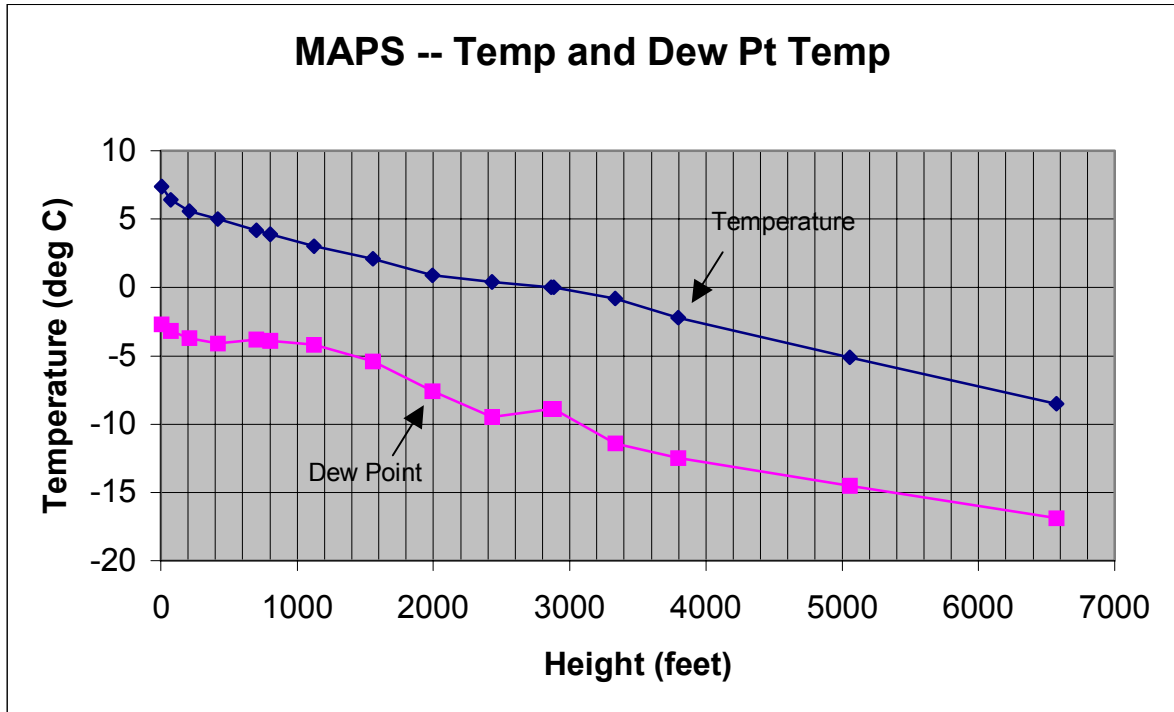
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| | | | | | | |
|---|-------|-------|------|------|-----|----|
| 5 | 10039 | 214 | 42 | -38 | 311 | 14 |
| 4 | 10000 | 245 | 39 | -39 | 311 | 14 |
| 5 | 9880 | 343 | 30 | -42 | 309 | 15 |
| 5 | 9721 | 474 | 21 | -54 | 309 | 19 |
| 5 | 9562 | 607 | 9 | -76 | 306 | 22 |
| 5 | 9403 | 741 | 4 | -95 | 305 | 26 |
| 4 | 9250 | 872 | 0 | -89 | 305 | 24 |
| 5 | 9244 | 878 | 0 | -89 | 305 | 24 |
| 5 | 9085 | 1017 | -8 | -114 | 310 | 22 |
| 5 | 8927 | 1157 | -22 | -125 | 307 | 17 |
| 4 | 8500 | 1541 | -51 | -145 | 310 | 18 |
| 5 | 8014 | 2003 | -85 | -169 | 313 | 20 |
| 5 | 7693 | 2319 | -88 | -196 | 309 | 28 |
| 5 | 7479 | 2537 | -81 | -229 | 306 | 34 |
| 5 | 7305 | 2721 | -71 | -272 | 303 | 39 |
| 5 | 7137 | 2902 | -61 | -336 | 300 | 43 |
| 4 | 7000 | 3053 | -65 | -383 | 298 | 47 |
| 5 | 6918 | 3146 | -67 | -412 | 297 | 49 |
| 5 | 6613 | 3496 | -83 | -381 | 296 | 53 |
| 5 | 6340 | 3822 | -97 | -348 | 296 | 55 |
| 5 | 6094 | 4126 | -110 | -331 | 297 | 57 |
| 5 | 5851 | 4438 | -123 | -323 | 298 | 59 |
| 5 | 5578 | 4801 | -141 | -319 | 297 | 62 |
| 5 | 5251 | 5257 | -169 | -332 | 295 | 64 |
| 4 | 5000 | 5621 | -195 | -354 | 294 | 63 |
| 5 | 4819 | 5896 | -215 | -371 | 294 | 63 |
| 5 | 4273 | 6769 | -284 | -440 | 293 | 64 |
| 4 | 4000 | 7233 | -322 | -468 | 293 | 67 |
| 5 | 3711 | 7762 | -365 | -499 | 292 | 70 |
| 5 | 3122 | 8933 | -465 | -581 | 291 | 76 |
| 4 | 3000 | 9194 | -486 | -598 | 291 | 77 |
| 5 | 2773 | 9709 | -526 | -631 | 292 | 80 |
| 5 | 2558 | 10225 | -563 | -656 | 292 | 82 |
| 4 | 2500 | 10369 | -573 | -661 | 292 | 82 |
| 5 | 2388 | 10660 | -592 | -671 | 293 | 82 |
| 5 | 2246 | 11040 | -609 | -674 | 292 | 81 |
| 5 | 2189 | 11201 | -605 | -672 | 292 | 78 |
| 5 | 2157 | 11293 | -595 | -670 | 290 | 76 |
| 5 | 2110 | 11432 | -589 | -665 | 288 | 73 |
| 5 | 2058 | 11587 | -585 | -660 | 285 | 71 |
| 5 | 2009 | 11739 | -581 | -657 | 282 | 69 |
| 5 | 1960 | 11894 | -577 | -655 | 279 | 67 |
| 5 | 1926 | 12004 | -569 | -658 | 277 | 68 |
| 5 | 1890 | 12126 | -562 | -666 | 278 | 68 |
| 5 | 1823 | 12353 | -566 | -689 | 281 | 66 |
| 5 | 1736 | 12660 | -578 | -719 | 283 | 65 |
| 5 | 1672 | 12897 | -577 | -723 | 281 | 66 |
| 5 | 1590 | 13217 | -572 | -723 | 279 | 66 |
| 4 | 1500 | 13583 | -577 | -734 | 279 | 68 |
| 5 | 1473 | 13697 | -578 | -737 | 279 | 68 |
| 5 | 1307 | 14451 | -578 | -755 | 276 | 67 |
| 5 | 1125 | 15394 | -588 | -789 | 274 | 56 |
| 4 | 1000 | 16129 | -595 | -795 | 266 | 53 |
| 5 | 913 | 16698 | -601 | -799 | 259 | 51 |

PLOT --- MAPS Winds



PLOT --- MAPS Temperature and Dew Point Temperature



The following data were obtained from Dr. Rod Cole from MIT Lincoln Laboratory Weather Sensing Group. The data are from the New York Integrated Terminal Weather System (ITWS).

Location: West Jamaica Bay --- 1410Z

| Height (feet) | Wind Speed (knots) | Wind Direction (degrees) |
|---------------|--------------------|--------------------------|
| 781.2 | 12.3 | 317.5 |
| 2133.3 | 20.6 | 322.2 |
| 3541.9 | 18.9 | 346.8 |
| 5020.0 | 21.2 | 342.1 |
| 6571.3 | 25.9 | 333.5 |
| 8215.6 | 34.1 | 322.7 |

Location: North Jamaica Bay --- 1410Z

| Height (feet) | Wind Speed (knots) | Wind Direction (degrees) |
|---------------|--------------------|--------------------------|
| 777.3 | 12.4 | 316.2 |
| 2129.4 | 21.1 | 330.4 |
| 3538.4 | 19.6 | 344.0 |
| 5016.2 | 21.9 | 340.3 |
| 6566.0 | 26.4 | 332.9 |
| 8209.2 | 34.3 | 322.7 |

JFK Runways --- 1410Z

| Height (feet) | Wind Speed (knots) | Wind Direction (degrees) |
|---------------|--------------------|--------------------------|
| 777.0 | 12.7 | 316.7 |
| 2129.4 | 20.9 | 330.5 |
| 3538.4 | 19.5 | 344.4 |
| 5016.2 | 21.9 | 340.7 |
| 6566.0 | 26.5 | 333.2 |
| 8209.2 | 34.3 | 322.7 |

Aircraft Data

From Meteorological Data Collection and Reporting System (MDCRS)

Ascent sounding from Newark, New Jersey (EWR) --- Starting south-southwest and turning to the northwest. At 4,920 feet the aircraft is 326 degrees at 3 nautical miles from EWR.

Time ... Time (Z)

PA ... Pressure Altitude (feet)

Wnd Dir ... Wind Direction (degrees)

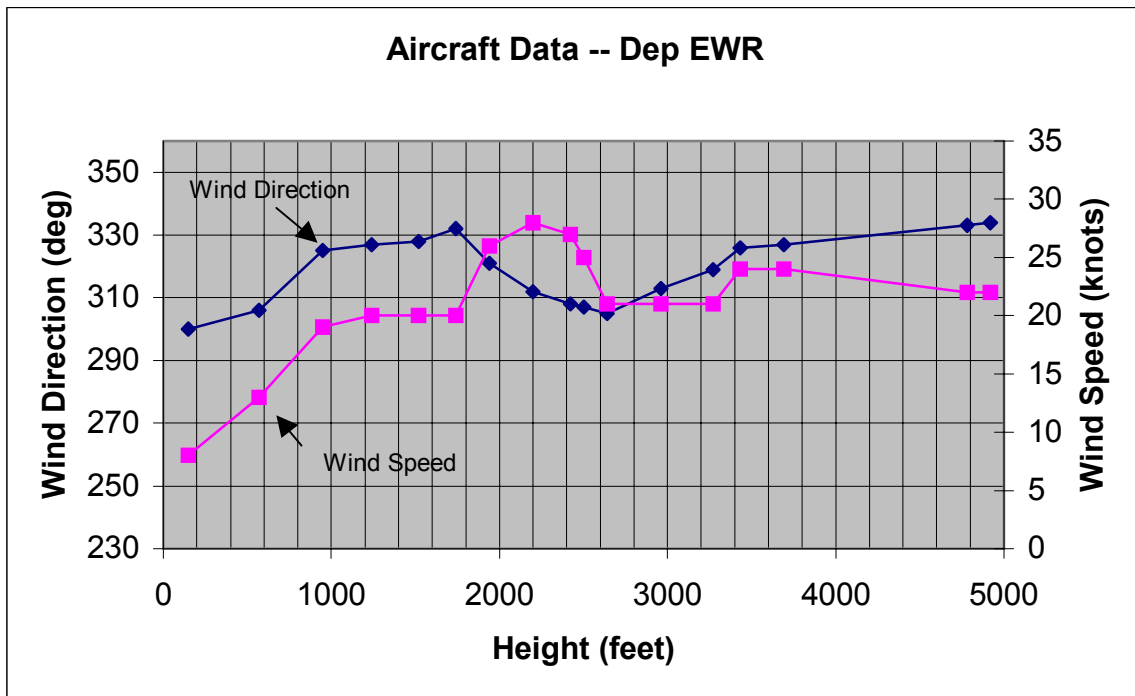
Wnd Spd ... Wind Speed (knots)

Temp ... Temperature (degrees C)

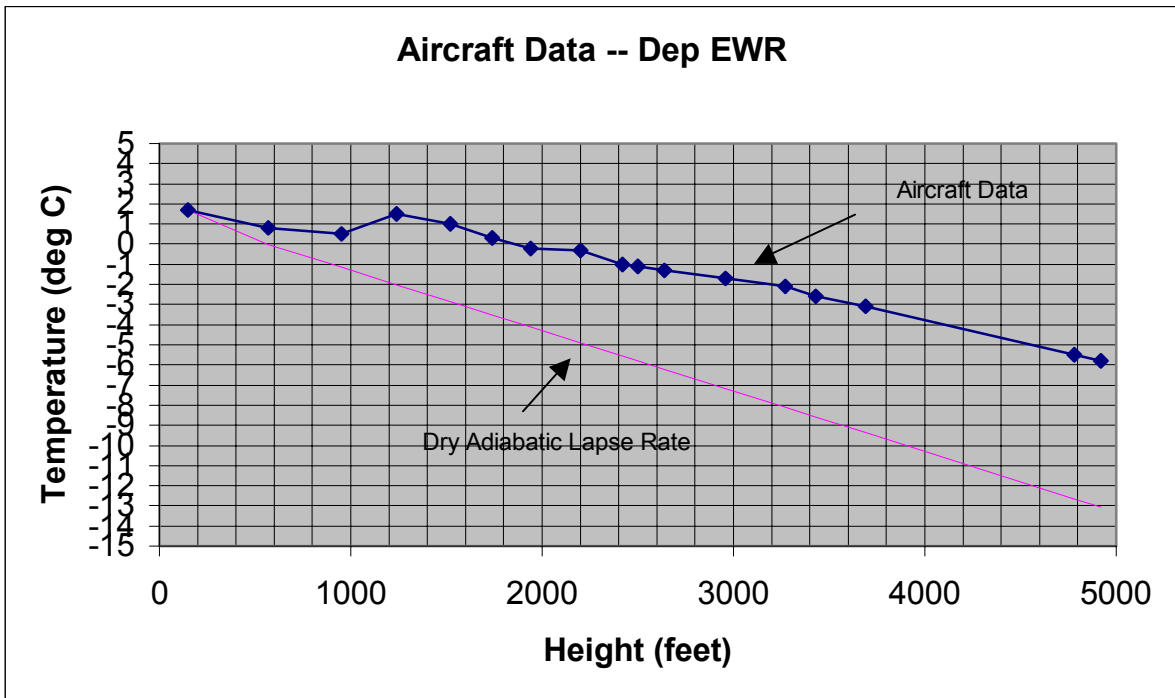
| Time | PA | Wnd Dir | Wnd Spd | Temp |
|------|-------|---------|---------|------|
| 1251 | 150 | 300 | 8 | 1.7 |
| 1251 | 570 | 306 | 13 | 0.8 |
| 1251 | 950 | 325 | 19 | 0.5 |
| 1251 | 1,240 | 327 | 20 | 1.5 |
| 1251 | 1,520 | 328 | 20 | 1.0 |

| | | | | |
|------|-------|-----|----|------|
| 1251 | 1,740 | 332 | 20 | 0.3 |
| 1252 | 1,940 | 321 | 26 | -0.2 |
| 1252 | 2,200 | 312 | 28 | -0.3 |
| 1252 | 2,420 | 308 | 27 | -1.0 |
| 1252 | 2,500 | 307 | 25 | -1.1 |
| 1252 | 2,640 | 305 | 21 | -1.3 |
| 1253 | 2,960 | 313 | 21 | -1.7 |
| 1253 | 3,270 | 319 | 21 | -2.1 |
| 1253 | 3,430 | 326 | 24 | -2.6 |
| 1253 | 3,690 | 327 | 24 | -3.1 |
| 1253 | 4,782 | 333 | 22 | -5.5 |
| 1254 | 4,920 | 334 | 22 | -5.8 |

PLOT – Wind Direction and Wind Speed



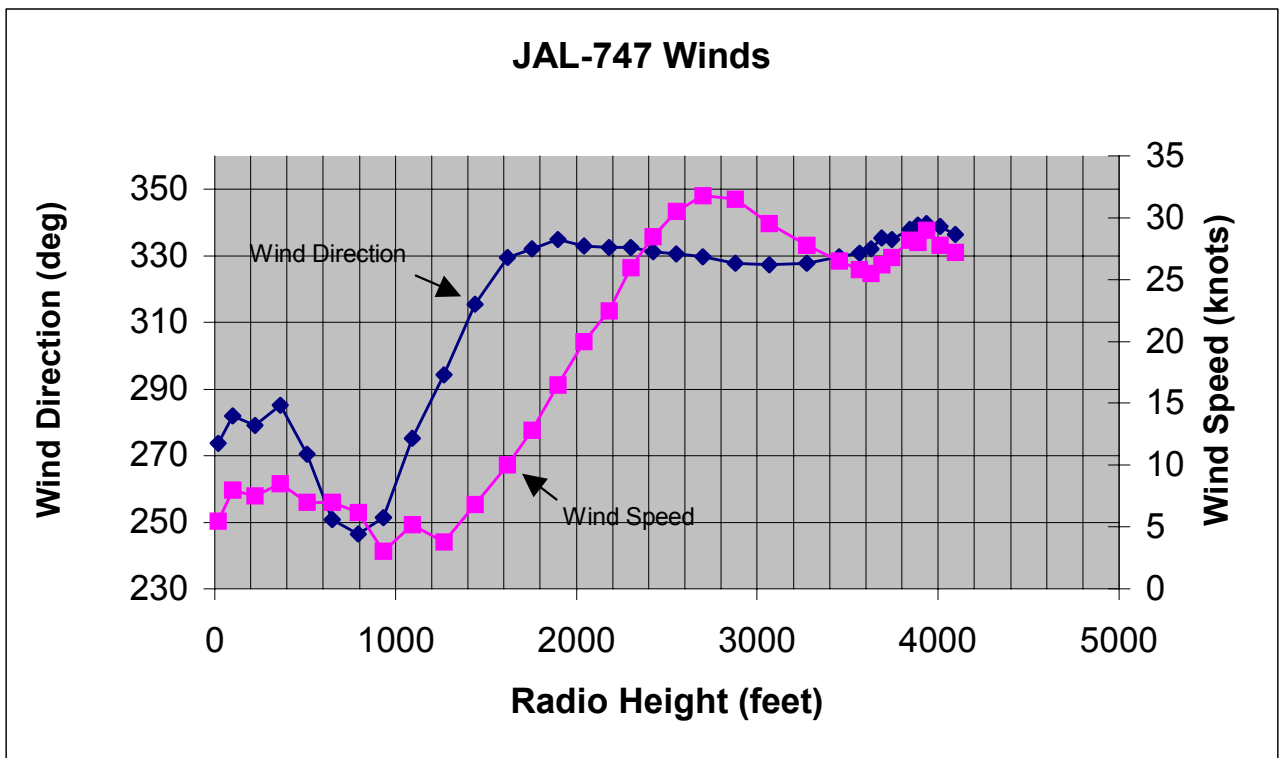
PLOT --- Temperature Data



Recorded and Derived Data from Japan Airlines (JAL) Boeing 747 Digital Flight Data Recorder (DFDR)

The JAL Boeing 747 (Flight 47) departed JFK immediately ahead of AAL 587

PLOT --- Recorded Winds

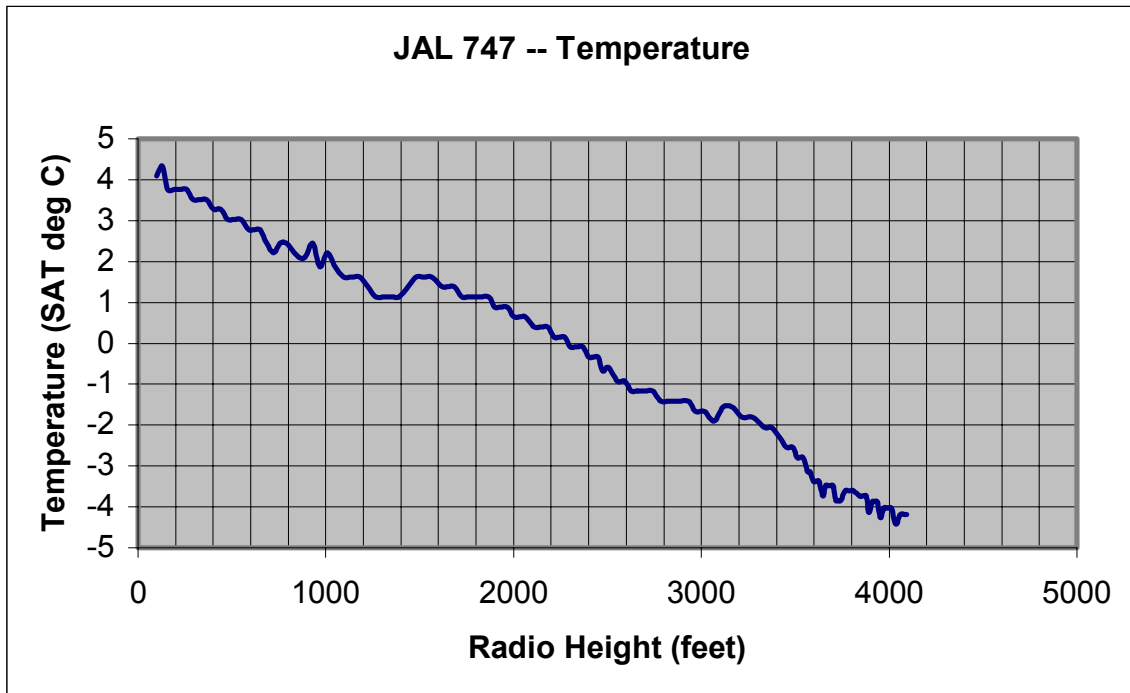


TABLE

Rad Height ... Radio Height in feet
 Wnd Dir ... Wind Direction in degrees
 Wnd Spd ... Wind Speed in knots

| Rad Height | Wnd Dir | Wnd Spd |
|------------|---------|---------|
| 20 | 273.6 | 5.5 |
| 100 | 282 | 8 |
| 224 | 279.2 | 7.5 |
| 364 | 285.2 | 8.5 |
| 512 | 270.4 | 7 |
| 650 | 250.8 | 7 |
| 792 | 246.5 | 6.2 |
| 932 | 251.5 | 3 |
| 1094 | 275.3 | 5.2 |
| 1266 | 294.3 | 3.8 |
| 1438 | 315.4 | 6.8 |
| 1620 | 329.4 | 10 |
| 1756 | 332.2 | 12.8 |
| 1898 | 335 | 16.5 |
| 2040 | 332.9 | 20 |
| 2180 | 332.6 | 22.5 |
| 2302 | 332.6 | 26 |
| 2424 | 331.2 | 28.5 |
| 2552 | 330.5 | 30.5 |
| 2698 | 329.8 | 31.8 |
| 2878 | 327.7 | 31.5 |
| 3066 | 327.3 | 29.5 |
| 3272 | 327.7 | 27.8 |
| 3452 | 329.8 | 26.5 |
| 3566 | 330.8 | 25.8 |
| 3628 | 332.2 | 25.5 |
| 3688 | 335.4 | 26.2 |
| 3744 | 335 | 26.8 |
| 3842 | 337.9 | 28.2 |
| 3888 | 339.3 | 28 |
| 3936 | 339.6 | 29 |
| 4012 | 338.9 | 27.8 |
| 4094 | 336.4 | 27.2 |

PLOT --- Derived Static Air Temperature



TABLE

Rad Hgt... Radio Height in feet.

Temp ... Temperature (SAT) in degrees C

| Rad Hgt | Temp |
|---------|----------|
| 100 | 4.086876 |
| 130 | 4.33274 |
| 158 | 3.765521 |
| 190 | 3.765521 |
| 224 | 3.765521 |
| 258 | 3.765521 |
| 292 | 3.519941 |
| 330 | 3.519941 |
| 364 | 3.519941 |
| 402 | 3.274361 |
| 438 | 3.274361 |
| 476 | 3.028782 |
| 512 | 3.028782 |
| 548 | 3.028782 |
| 588 | 2.783202 |
| 618 | 2.783202 |
| 650 | 2.783202 |
| 686 | 2.452912 |
| 722 | 2.207626 |
| 756 | 2.452912 |
| 792 | 2.452912 |
| 830 | 2.207626 |
| 856 | 2.112622 |
| 890 | 2.112622 |
| 932 | 2.452912 |
| 968 | 1.867639 |
| 1008 | 2.207626 |
| 1050 | 1.867639 |
| 1094 | 1.622656 |
| 1138 | 1.622656 |
| 1184 | 1.622656 |
| 1222 | 1.377673 |
| 1266 | 1.13269 |
| 1314 | 1.13269 |
| 1354 | 1.13269 |
| 1392 | 1.13269 |
| 1438 | 1.377673 |
| 1478 | 1.622656 |
| 1524 | 1.622656 |
| 1566 | 1.622656 |
| 1620 | 1.377673 |

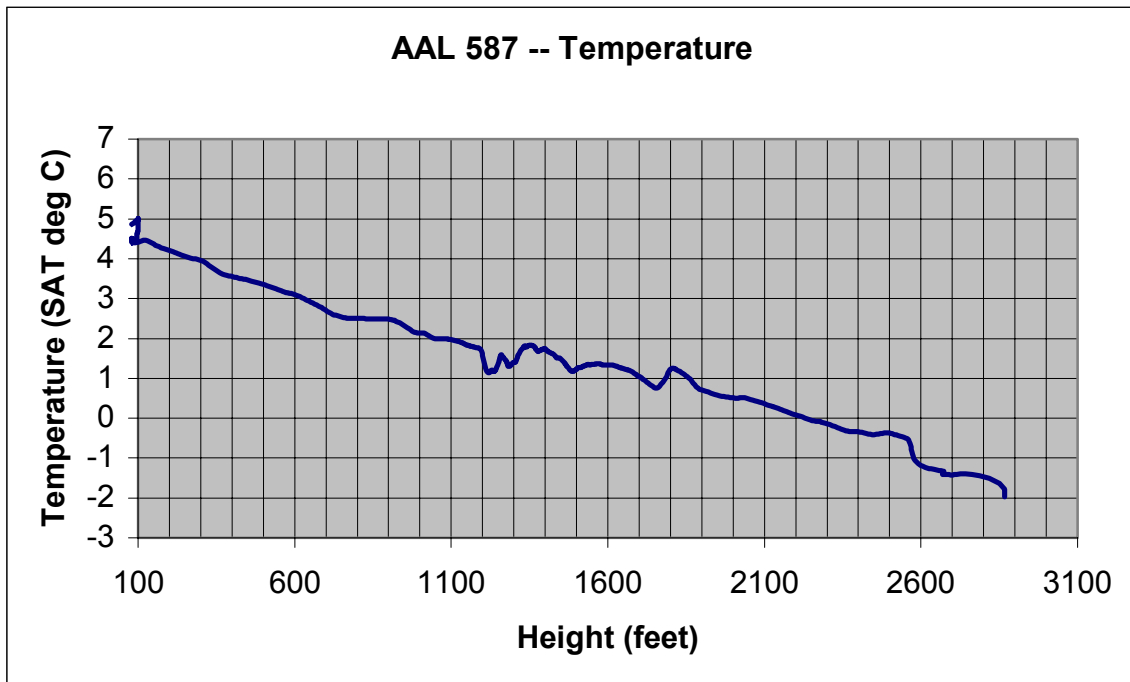
| | |
|------|----------|
| 1648 | 1.377673 |
| 1684 | 1.377673 |
| 1726 | 1.13269 |
| 1756 | 1.13269 |
| 1794 | 1.13269 |
| 1822 | 1.13269 |
| 1868 | 1.13269 |
| 1898 | 0.887708 |
| 1928 | 0.887708 |
| 1968 | 0.887708 |
| 2002 | 0.642725 |
| 2040 | 0.642725 |
| 2062 | 0.642725 |
| 2110 | 0.397742 |
| 2146 | 0.397742 |
| 2180 | 0.397742 |
| 2214 | 0.152759 |
| 2244 | 0.152759 |
| 2272 | 0.152759 |
| 2302 | -0.09222 |
| 2334 | -0.09222 |
| 2368 | -0.09222 |
| 2398 | -0.33721 |
| 2424 | -0.33721 |
| 2450 | -0.33721 |
| 2476 | -0.6843 |
| 2506 | -0.58219 |
| 2552 | -0.92897 |
| 2594 | -0.92897 |
| 2626 | -1.17365 |
| 2662 | -1.17365 |
| 2698 | -1.17365 |
| 2740 | -1.17365 |
| 2784 | -1.41832 |
| 2826 | -1.41832 |
| 2878 | -1.41832 |
| 2932 | -1.41832 |
| 2970 | -1.66299 |
| 3018 | -1.66299 |
| 3066 | -1.90766 |
| 3114 | -1.56212 |
| 3164 | -1.56212 |
| 3216 | -1.8071 |
| 3272 | -1.8071 |
| 3336 | -2.05209 |
| 3374 | -2.05209 |
| 3414 | -2.29707 |

| | |
|------|----------|
| 3452 | -2.54205 |
| 3488 | -2.54205 |
| 3510 | -2.78703 |
| 3542 | -2.78703 |
| 3566 | -3.13101 |
| 3580 | -3.13101 |
| 3596 | -3.37568 |
| 3612 | -3.37568 |
| 3628 | -3.37568 |
| 3646 | -3.72901 |
| 3662 | -3.48466 |
| 3674 | -3.48466 |
| 3688 | -3.48466 |
| 3702 | -3.48466 |
| 3714 | -3.8479 |
| 3724 | -3.8479 |
| 3744 | -3.8479 |
| 3766 | -3.60388 |
| 3782 | -3.60388 |
| 3812 | -3.60388 |
| 3842 | -3.73328 |
| 3860 | -3.73328 |
| 3866 | -3.73328 |
| 3878 | -3.73328 |
| 3888 | -4.11615 |
| 3896 | -4.11615 |
| 3908 | -3.87281 |
| 3918 | -3.87281 |
| 3936 | -3.87281 |
| 3954 | -4.26539 |
| 3972 | -4.0224 |
| 3992 | -4.0224 |
| 4012 | -4.0224 |
| 4036 | -4.42463 |
| 4058 | -4.18201 |
| 4086 | -4.18201 |
| 4094 | -4.18201 |

Source of Wind and SAT data: NTSB Aerospace Engineer, Vehicle Recorders Division.

Derived and Recorded Data from AAL 587 DFDR

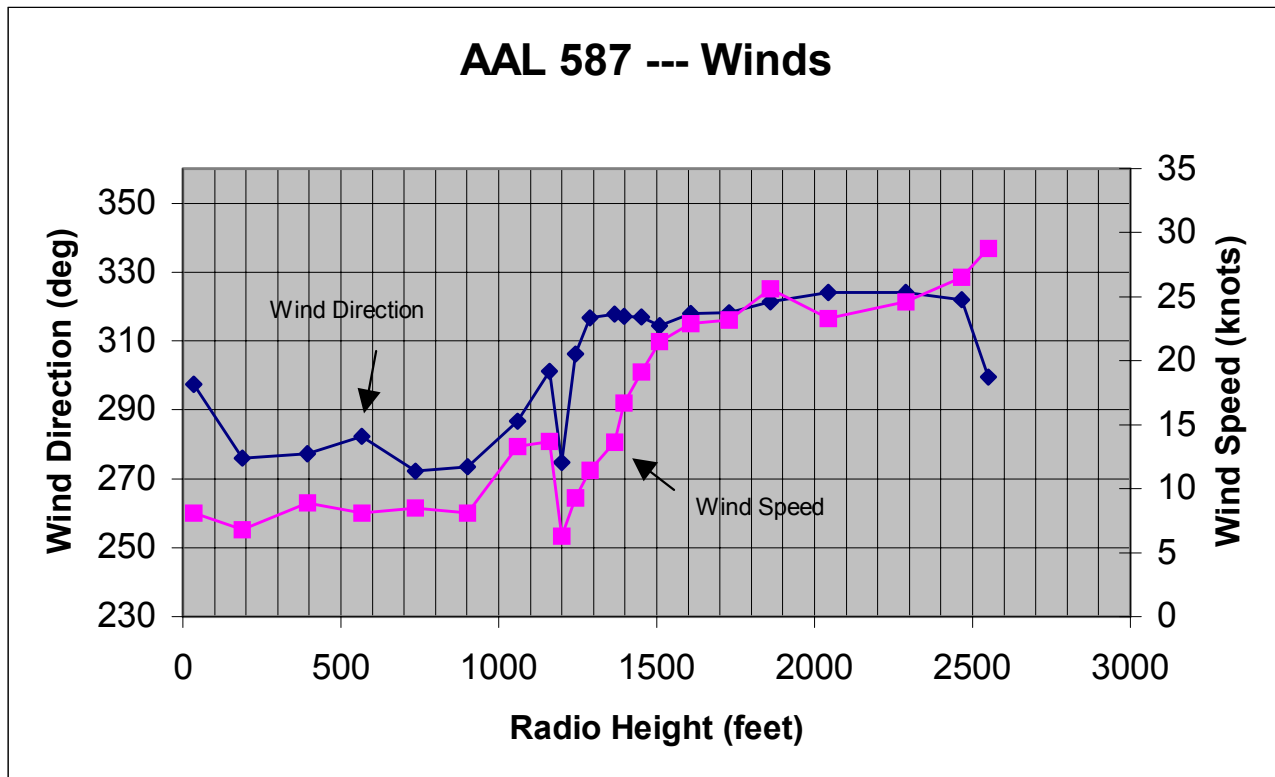
PLOT --- Derived Static Air Temperature (degrees C)



Height ... Corrected Pressure Altitude.

Source: SAT derived from the Total Temperature, Calibrated Airspeed, and Pressure Altitude recorded on AAL 587's DFDR (see NTSB Solid State Flight Data Recorder Factual Report for DFDR data).

PLOT --- Recorded Winds

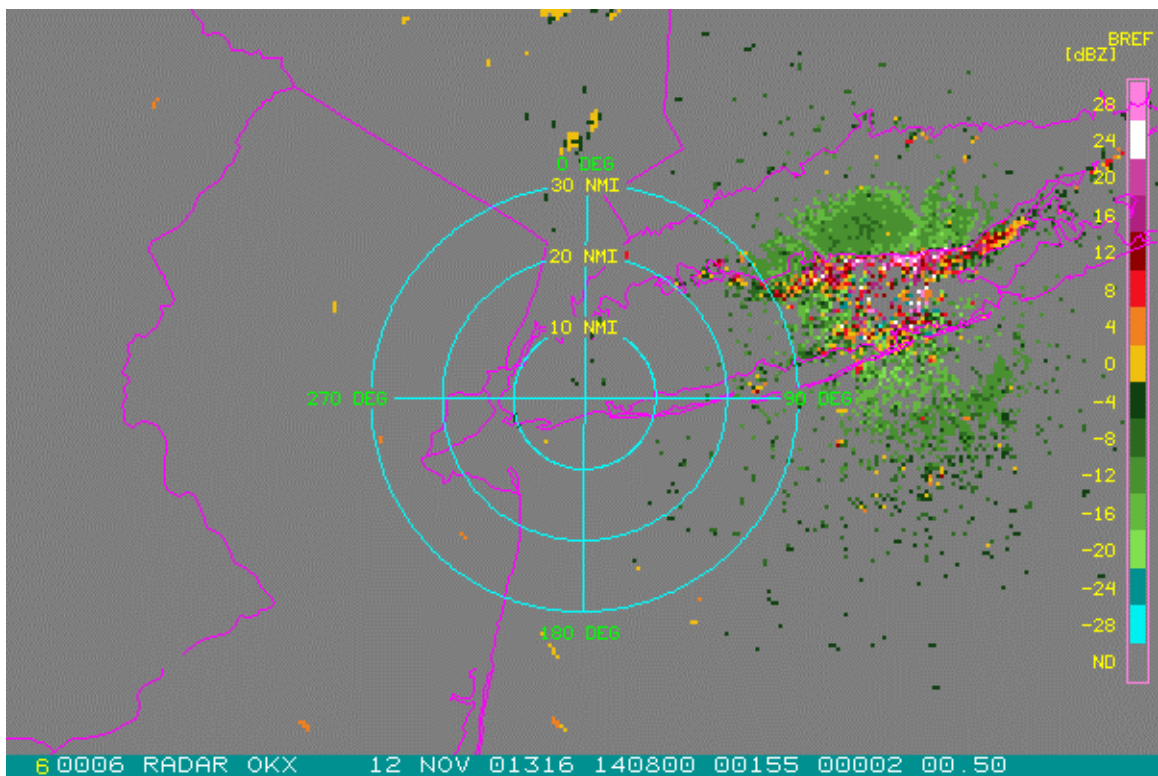


Note: Wind speed samples plotted at the radio height of the nearest wind direction samples.

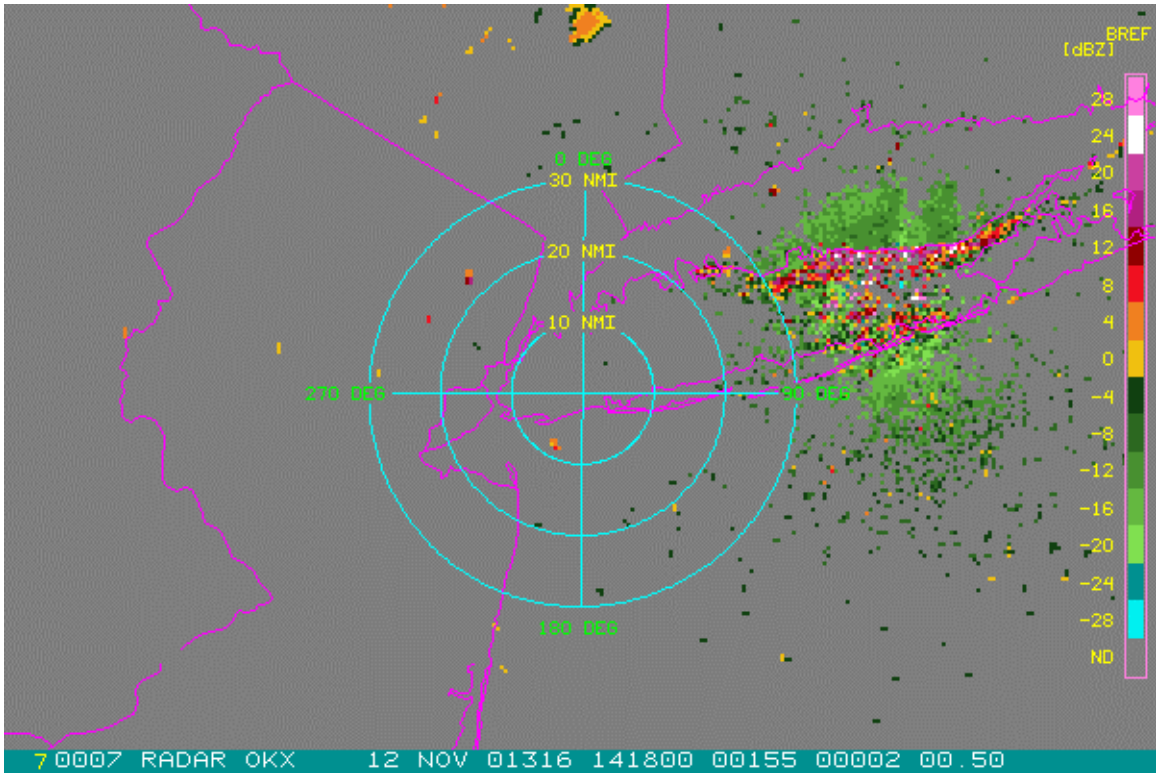
Source: NTSB Solid State Flight Data Recorder Factual Report (DCA02MA001).

Weather Radar Data

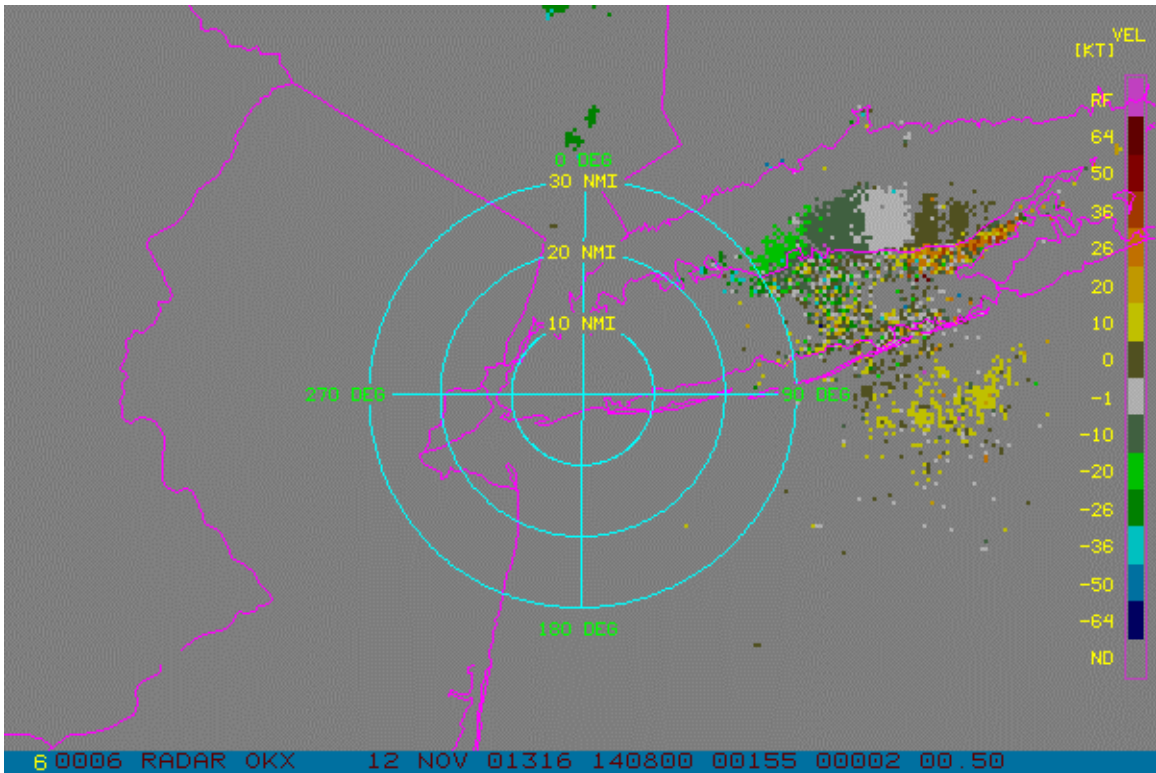
Weather radar data from the Upton, New York, Doppler Weather Radar (KOKX). Images were generated using McIDAS.



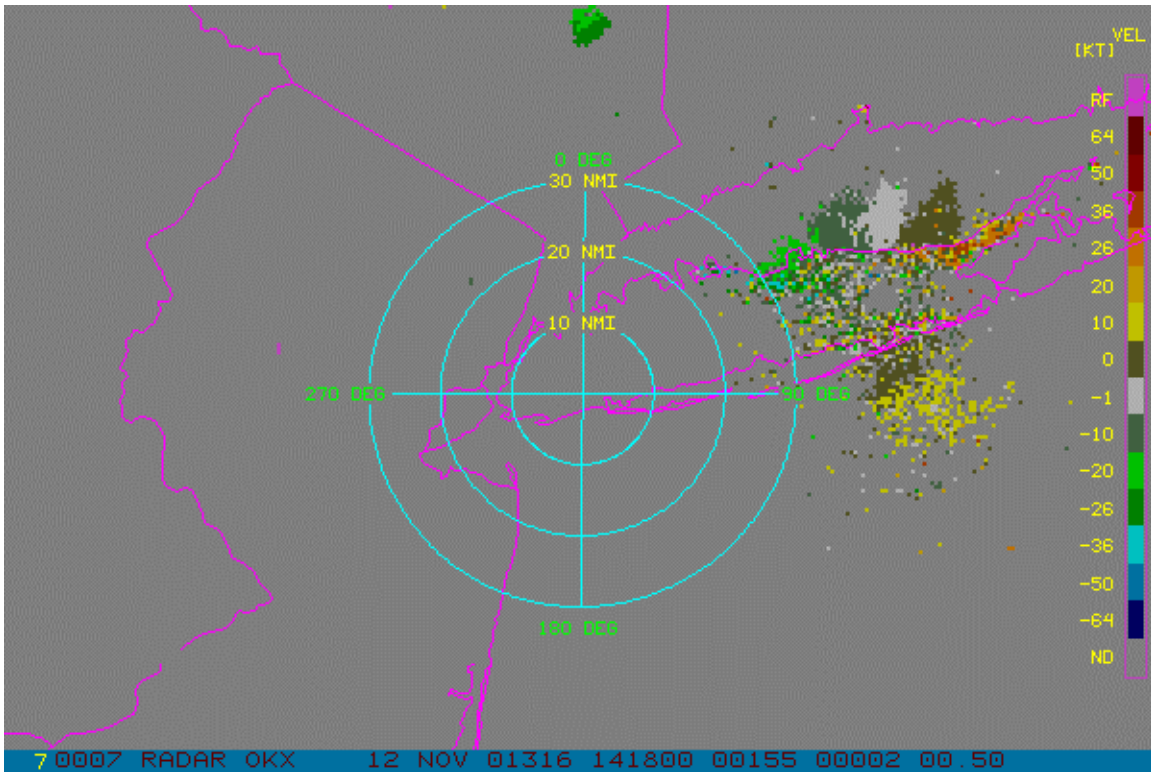
KOKX Base Reflectivity Image; 1408Z; 0.5 degree elevation angle; polar grid centered at KJFK; 2X blow up; clear air Doppler mode; weather radar echo intensities in dBZ (see color bar on right side of the image).



KOKX Base Reflectivity Image; 1418Z; 0.5 degree elevation angle; polar grid centered at KJFK; 2X blow up; clear air Doppler mode; weather radar echo intensities in dBZ (see color bar on right side of the image).



KOKX Base Radial Velocity Image; 1408Z; 0.5 degree elevation angle; polar grid centered at KJFK; 2X blow up; clear air Doppler mode; radial velocities in knots (see color bar on right side of the image); plus values away from radar, negative values towards radar. The radar is located about 072 degrees at 44 nautical miles from KJFK.



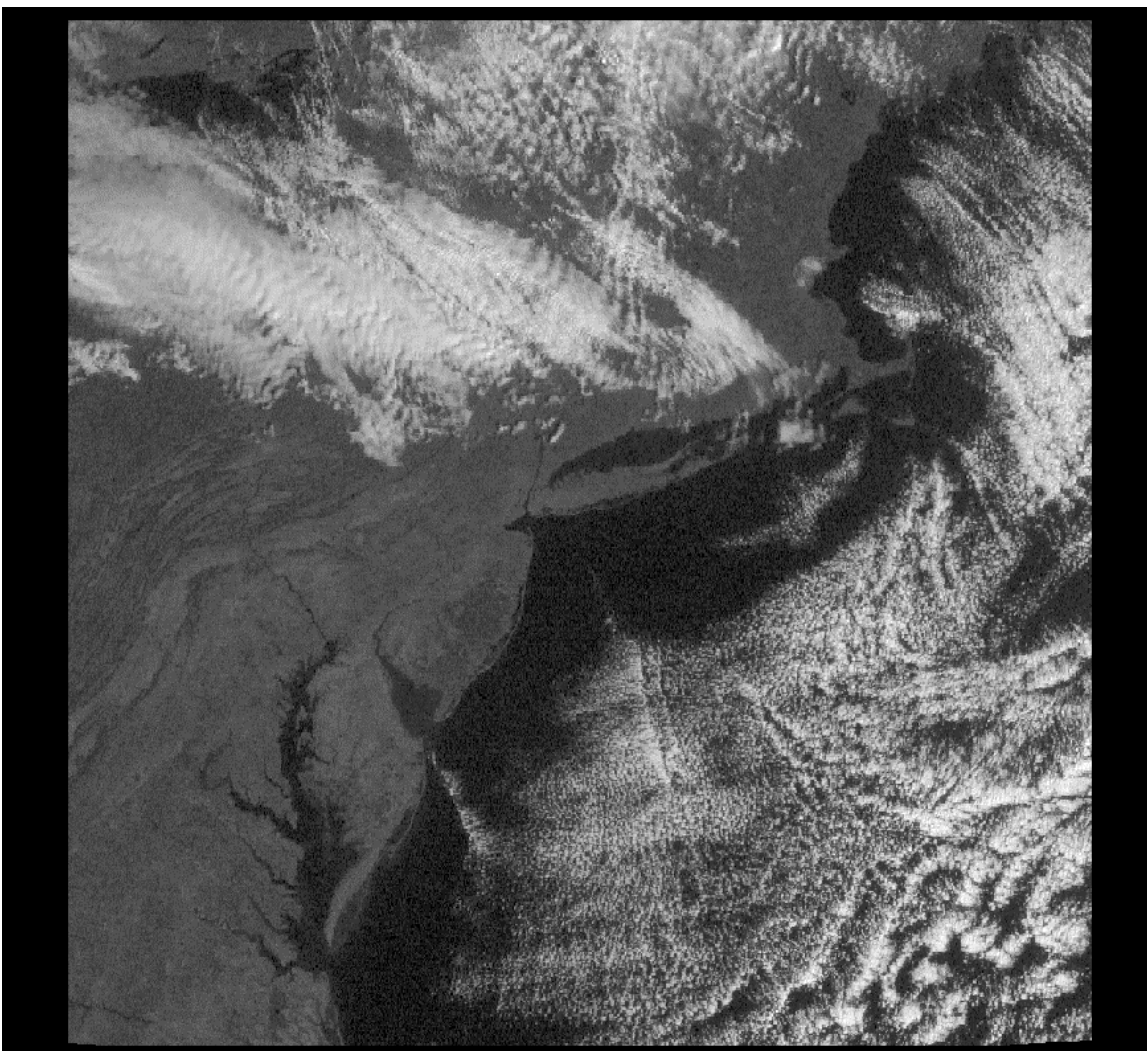
KOKX Base Radial Velocity Image; 1418Z; 0.5 degree elevation angle; polar grid centered at KJFK; 2X blow up; clear air Doppler mode; radial velocities in knots (see color bar on right side of the image); plus values away from radar, negative values towards radar.

Velocity Azimuth Display (VAD) winds from KOKX ...

1408Z ... Height of 1,000 feet winds northwest at 15 knots; height of 2,000 feet winds northwest at 25 knots; height of 3,000 feet winds northwest at 25 knots.

1418Z ... Height of 1,000 feet winds northwest at 15 knots; Height of 2,000 feet winds northwest at 25 knots; Height of 3,000 feet winds northwest at 30 knots.

Satellite Data



GOES 8 Visible Image for 1409Z November 12, 2001 (from American Airlines Weather Services).

In-Flight Weather Advisories

AIRMET Tango Update 1 for Turbulence (BOST WA 120845)
Issued November 12, 2001 at 0845Z
Valid until November 12 at 1500Z
Occasional moderate turbulence below 8,000 feet due to gusty
northwesterly winds.

The accident area was contained in the area encompassed by this AIRMET.

There were no SIGMETs, or Convective SIGMETs in effect for the time and
area of the accident.

There were no New York Center Weather Advisories in effect for the time
and area of the accident.

AIRMETs, SIGMETs, and Convective SIGMETs are issued by the National
Weather Service Aviation Weather Center in Kansas City, Missouri.

Text of AIRMETs ...

BOST WA 120845
AIRMET TANGO UPDT 1 FOR TURB VALID UNTIL 121500

.
AIRMET TURB...ME NH VT MA RI CT NY PA NJ AND CSTL WTRS
FROM 70NW PQI TO YSJ TO ACK TO CYN TO HAR TO SYR TO MSS TO YSC
TO 70NW PQI
OCNL MOD TURB BLW 080 DUE TO GUSTY NWLY WND. CONDS DVLPG AFT
12Z CONTG BYD 15Z THRU 21Z.

BOST WA 121445
AIRMET TANGO UPDT 2 FOR TURB VALID UNTIL 122100

.
AIRMET TURB...ME NH VT MA RI CT NY PA NJ MD DE AND CSTL WTRS
FROM 70NW PQI TO 30NNE PQI TO 50WSW YSJ TO ACK TO SIE TO HAR TO
SYR TO MSS TO YSC TO 70NW PQI
OCNL MOD TURB BLW 080 DUE TO GUSTY NWLY WND. CONDS CONTG BYD
21Z ENDG 00-02Z.

.....

Flight Release

The Weather Briefing Message (WXM) for AA flight 587 contained Map Features, the
METAR's for JFK, Santo Domingo (SDQ) and the alternate airport, San Juan, PR, (SJU),
TAF's for all three locations, Convective SIGMETs, NOTAM's and miscellaneous other
information.

The TAF for JFK, issued by American Airlines Weather Services, was:

Valid from November 12, 0900Z, through November 12, 2300Z, 2001.

Winds 300 degrees at 9 knots, visibility greater than 6 statute miles, sky clear.
From 1300Z, winds 310 degrees at 12 knots, gusting to 22 knots, visibility greater than 6 miles, few clouds at 5,000 feet, temporarily clouds scattered at 5,000 feet.

Interviews

Interview with Jerry Caldwell, contract weather observer at JFK

Interviewed by Greg Salottolo and Warren Qualley on Tuesday, November 13 at the KJFK weather observation office.

Jerry Caldwell is employed by Hepwell Co. Ltd, of Huntington, NY, and has worked in this capacity since May 1990. The observer's office is located on the west side of the airport, just northeast of the departure end of runway 31L. The office is on the third floor and has windows that provide a view from southeast through southwest.

Caldwell came on duty at 1200Z on Monday, November 12, and worked a 12-hour shift. He noted that all equipment was operating normally and that the weather was good. He noted that there were a few clouds, determining the height by using a chart that calculates the convective condensation level. He also stated that there was a wildlife sanctuary just southwest of the runway and that there were a large number of birds present that day. When asked if he could have included that in the Remarks section of the special report, he stated that he could have but rarely did so, since birds are a transitory phenomenon.

He noted that he didn't hear any aircraft taking off on runway 31L, the one which was used by AA587. From his desk he saw the smoke plume after the accident and prepared to take a Special weather report. Just prior to doing so, the tower contacted him to take the observation. Caldwell said that he noted the smoke plume to the south in the special report, which was issued at 1425Z.

Interview with Michael Wyllie, Meteorologist-in-Charge of the Weather Service Forecast Office at Upton, NY

Interviewed by Greg Salottolo and Warren Qualley on Wednesday, November 14 at the National Weather Service Forecast Office at Upton, New York.

Wyllie provided upper air data, TAF's, METAR's and the SPECI (weather special) valid at the time of the accident. He also provided color copies of base reflectivity and base radial velocity from the WSR-88D Doppler weather radar, also located at Upton (OKX). The imagery was time-stamped 1427Z, shortly after the accident, and apparently depicted the smoke plume from the accident. While at the office, loops of Doppler weather radar Base Reflectivity, Base Velocity, and Spectrum Width data (1338Z – 1437Z) were

reviewed. There is an Integrated Terminal Weather System (ITWS) display for Newark, New Jersey (KEWR), in the forecast office, but data are not archived.

Gregory D. Salottolo
National Resource Specialist
Meteorology
July 8, 2002