



## **NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety  
Washington, D.C. 20594

February 14, 2013

### **Group Chairman's Weather Factual**

# **METEOROLOGY**

**DCA13MM005**

## Table Of Contents

A.	ACCIDENT .....	3
B.	METEOROLOGY GROUP .....	3
C.	SUMMARY .....	3
D.	DETAILS OF THE INVESTIGATION .....	3
E.	FACTUAL INFORMATION .....	4
1.0	Synoptic Situation.....	4
1.1	Surface Analysis Chart .....	4
1.2	Upper Air Charts.....	5
2.0	Surface Observations .....	10
3.0	Upper Air Data.....	14
4.0	Satellite Data.....	16
5.0	Radar Imagery Information.....	17
5.1	Volume Scan Strategy.....	17
5.2	Beam Height Calculation.....	18
5.3	Reflectivity.....	19
5.4	Base Reflectivity and Lightning Data.....	20
6.0	Terminal Aerodrome Forecast .....	21
7.0	Area Forecast .....	21
8.0	National Weather Service Area Forecast Discussion .....	23
9.0	Astronomical Data .....	26
F.	LIST OF ATTACHMENTS .....	26

## **A. ACCIDENT**

Location: 1 mile south of New York, New York  
Date: January 9, 2013  
Time: approximately 0841 eastern standard time (1341 UTC<sup>1</sup>)  
Vehicle: Seastreak Wall Street

## **B. METEOROLOGY GROUP**

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## **C. SUMMARY**

For a summary of the accident, refer to the *Accident Summary* report, which is available in the docket for this investigation.

## **D. DETAILS OF THE INVESTIGATION**

The National Transportation Safety Board's (NTSB) Meteorologist was not on scene for this investigation and gathered all the weather data for this investigation from the NTSB's Washington D.C. office and from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Climatic Data Center (NCDC). All times are eastern standard time (EST) on January 9, 2013, and are based upon the 24-hour clock, where local time is -5 hours from UTC, and UTC=Z (unless otherwise noted). Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The accident location was located at latitude 40.70° N, longitude 74.01° W.

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<sup>1</sup> UTC – is an abbreviation for Coordinated Universal Time.

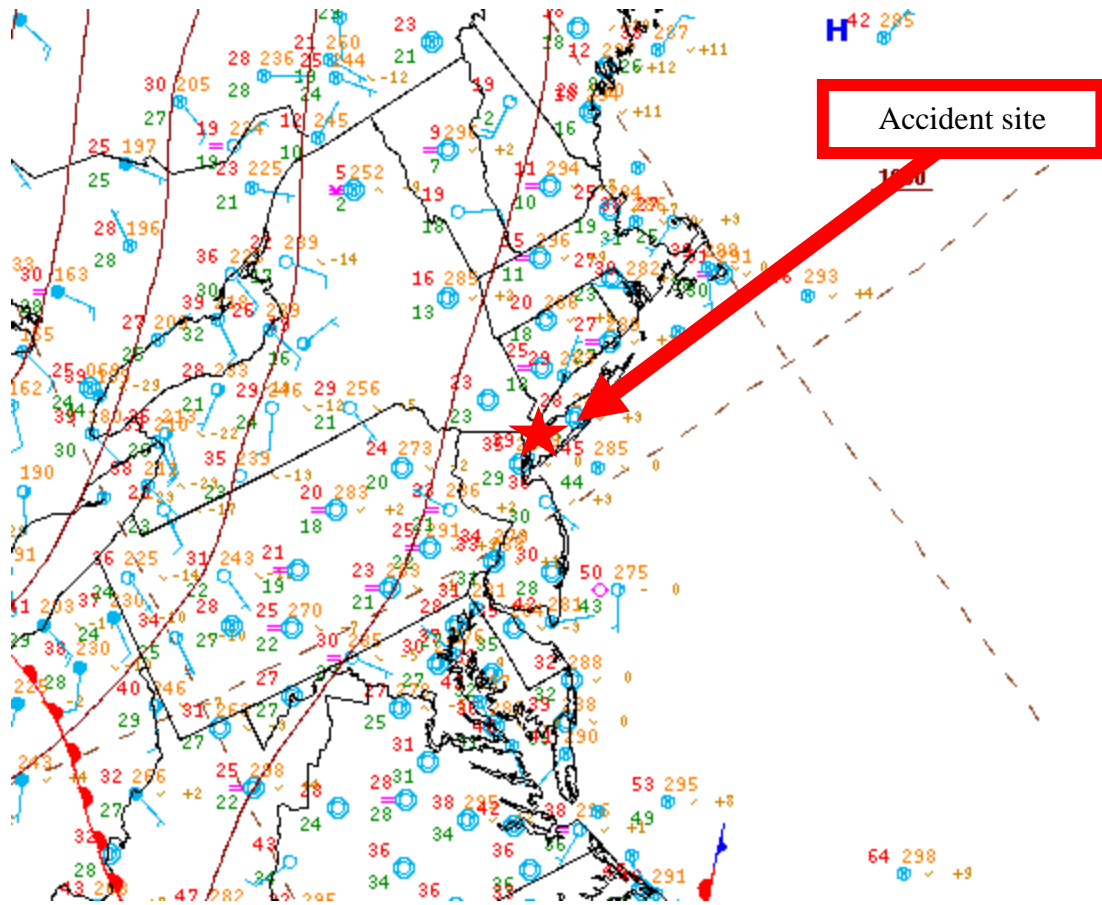
## **E. FACTUAL INFORMATION**

### **1.0 Synoptic Situation**

The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction (NCEP), and the Hydrometeorological Prediction Center (HPC) located in College Park, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found in the, joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC-0045G CHG 1.

### **1.1 Surface Analysis Chart**

The NWS Surface Analysis Chart for 0700 EST is provided as figure 1, with the approximate location of the accident site marked. The chart depicted a warm front located across the Ohio Valley, with a surface high pressure system with a surface pressure of 1030-hectopascals (hPa) located in the northwest Atlantic Ocean. The station models around the accident site depicted air temperatures in the mid 40’s to low 20’s Fahrenheit (F), with temperature-dew point spreads of 10° F or less, light and variable winds less than 5 knots, mostly clear to partly cloudy skies, and a few locations with patchy fog.



**Figure 1 – NWS Surface Analysis Chart for 0700 EST**

## 1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0700 EST at 925-, 850-, 700-, 500-, and 250-hPa are presented in figures 2 through 6. The 925- and 850-hPa charts depicted southwest winds between 20 and 35 knots over the accident site near the accident time. At 500-hPa a mid-level trough was located across southern Canada and the Great Lakes region.

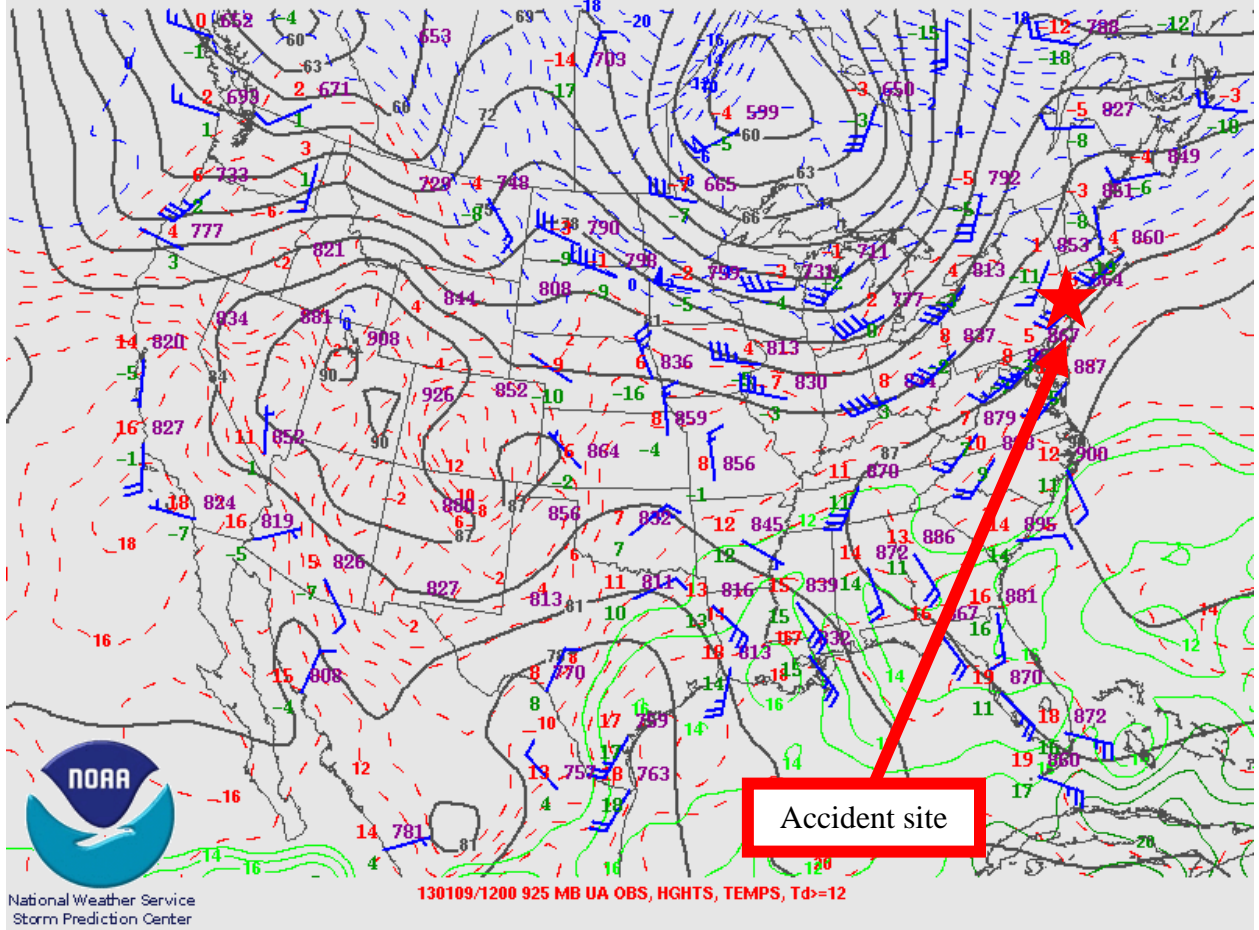


Figure 2 – 925-hPa Constant Pressure Chart for 0700 EST

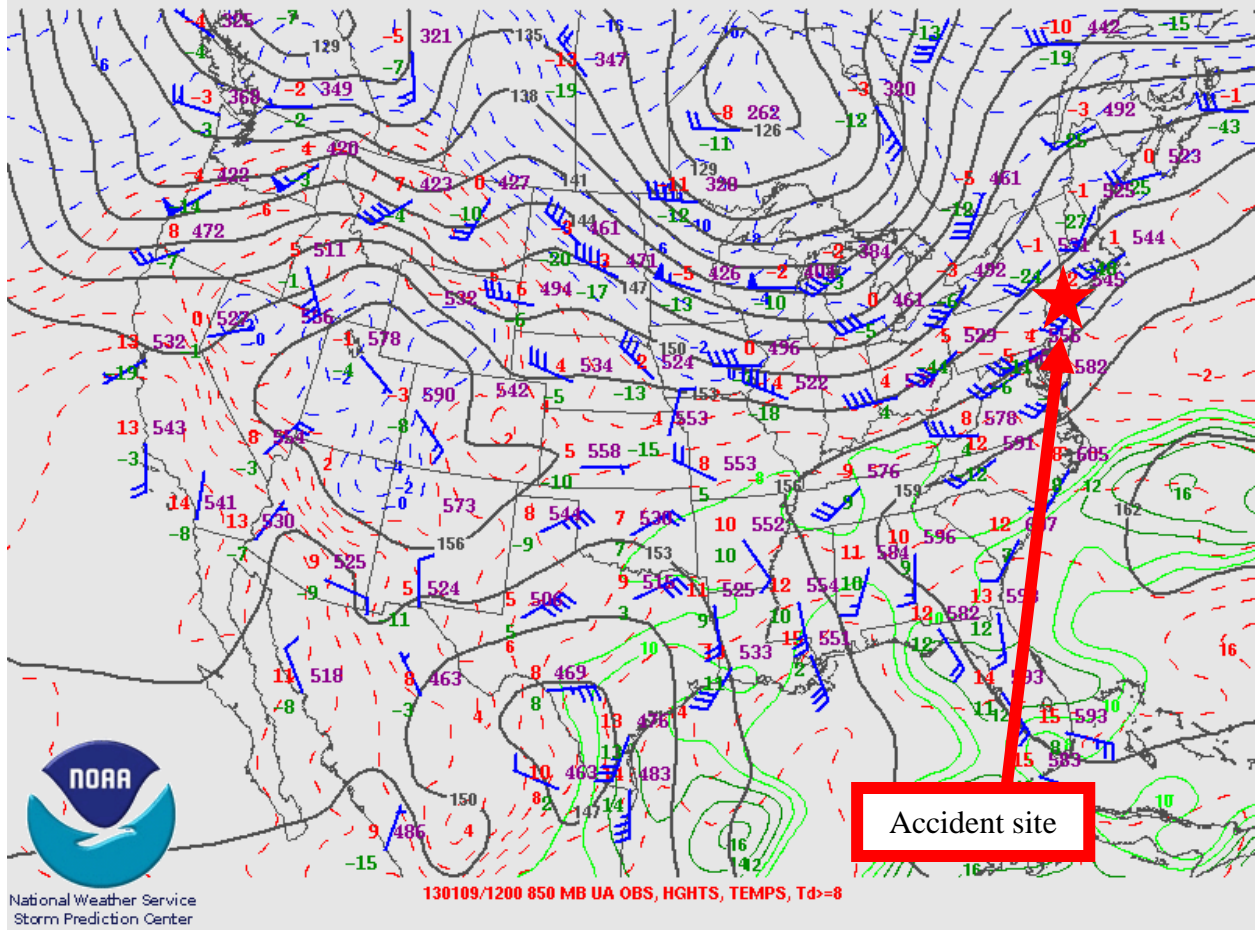


Figure 3 – 850-hPa Constant Pressure Chart for 0700 EST

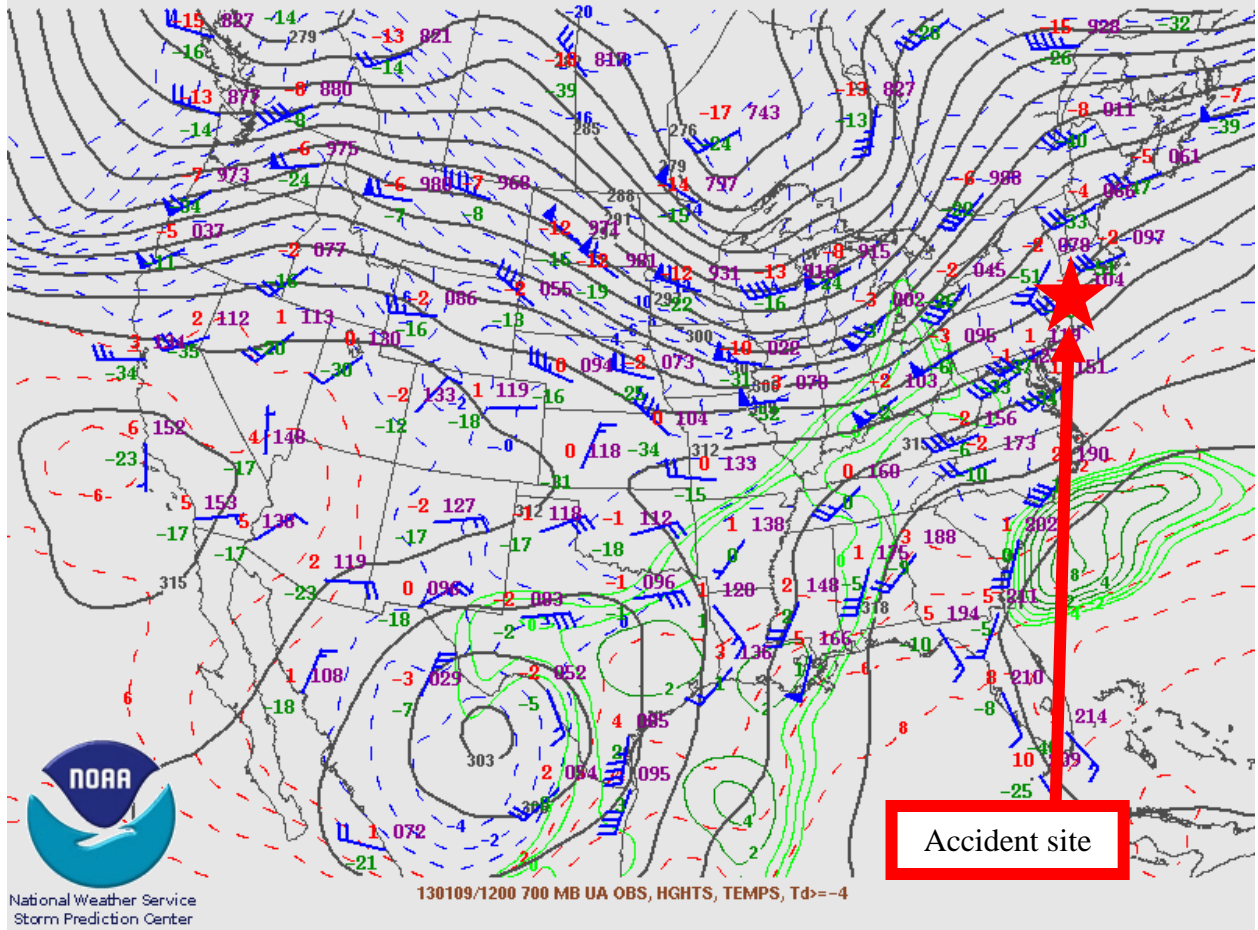


Figure 4 – 700-hPa Constant Pressure Chart for 0700 EST



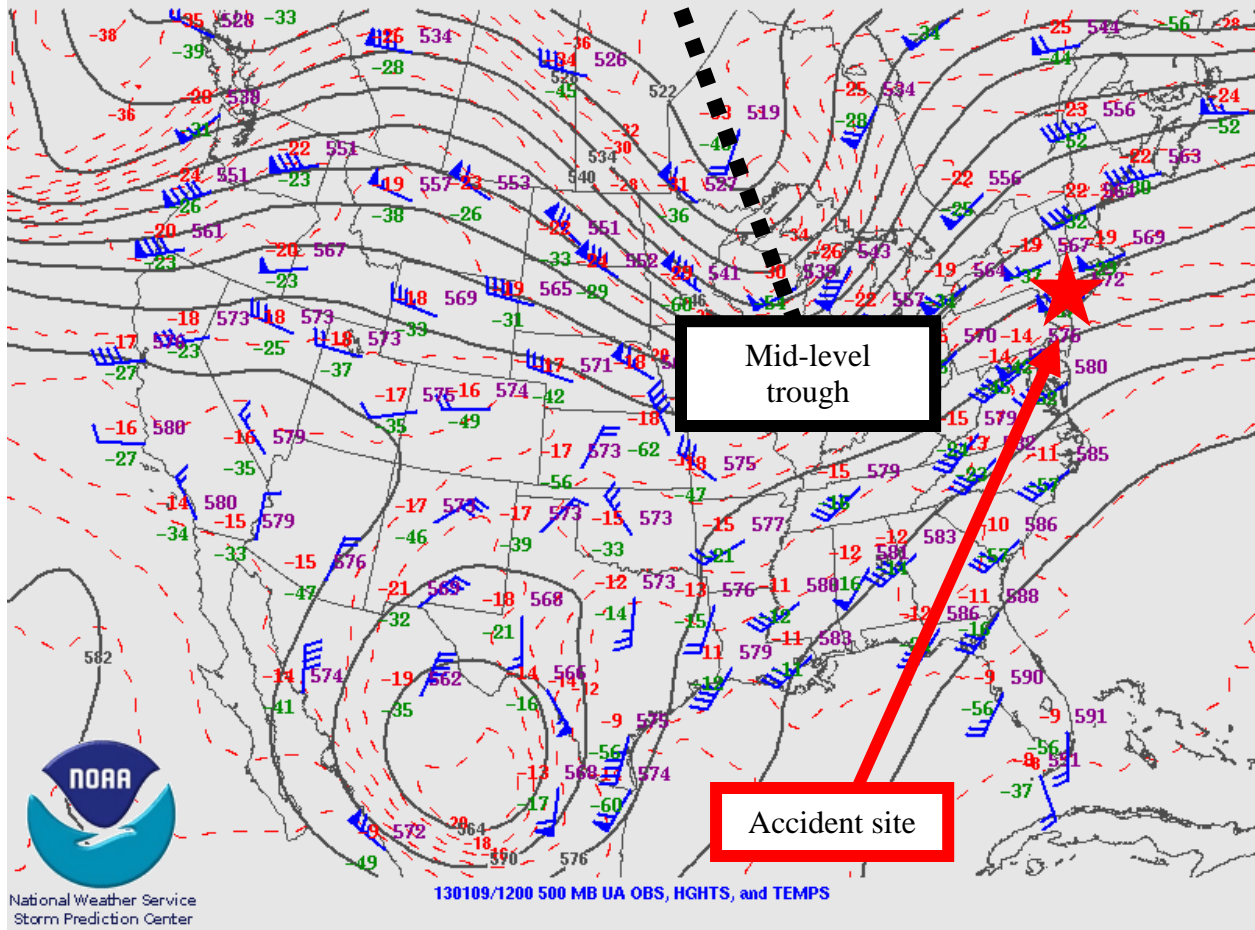
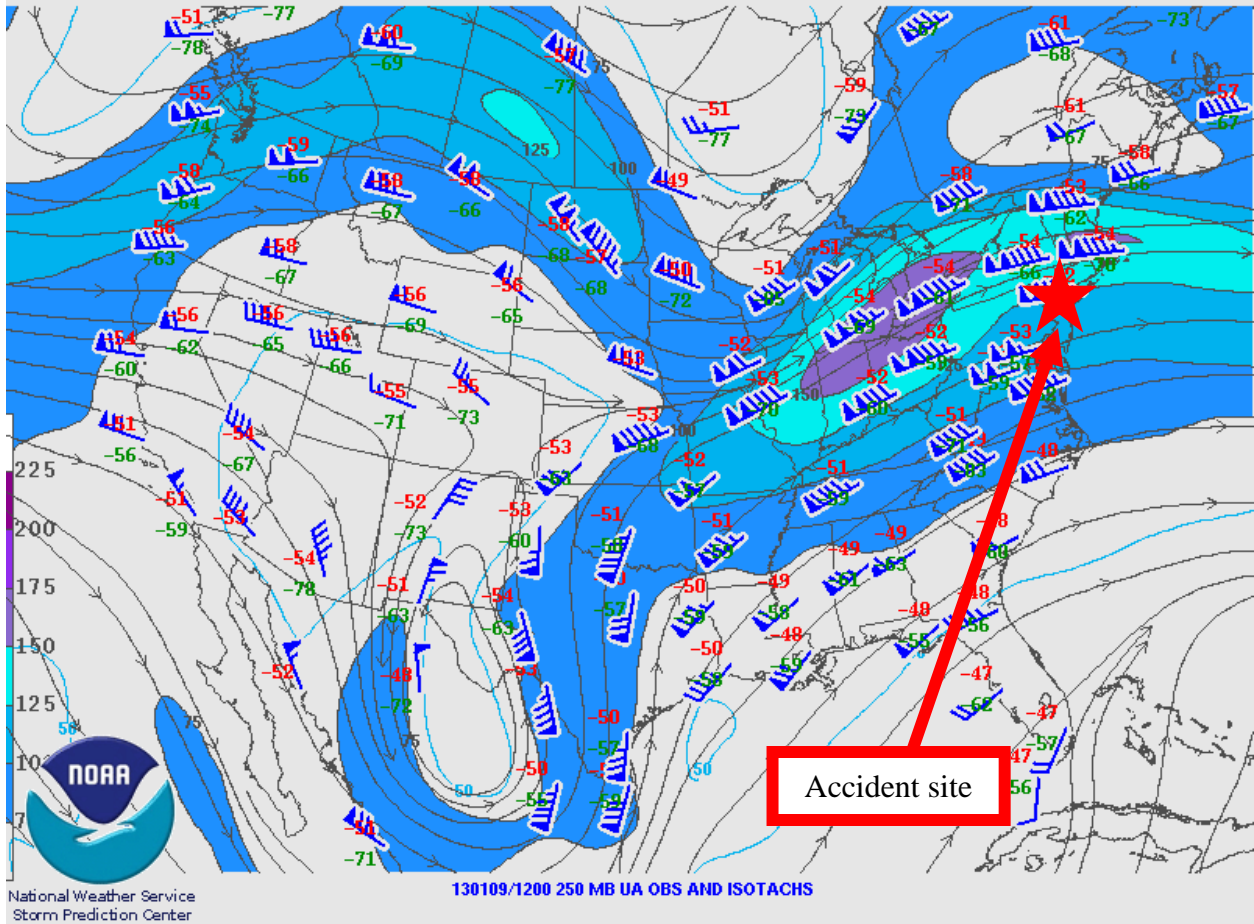


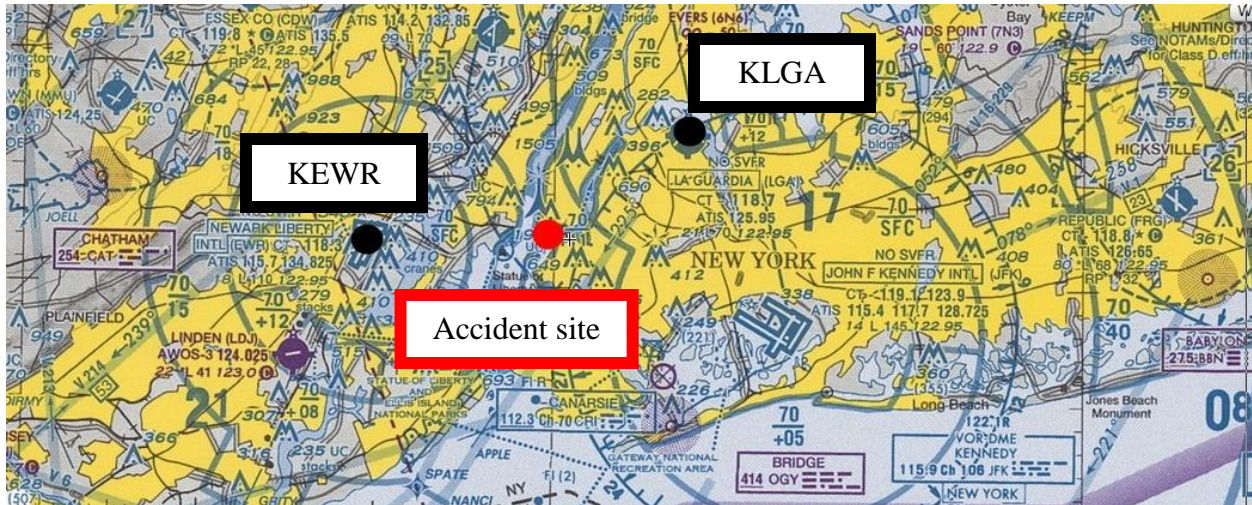
Figure 5 – 500-hPa Constant Pressure Chart for 0700 EST



**Figure 6 – 250-hPa Constant Pressure Chart for 0700 EST**

## 2.0 Surface Observations

The area surrounding the accident site was documented utilizing official NWS Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language.



**Figure 7 – Map of New York City with the location of the accident site and surface observation sites**

La Guardia Airport (KLGA) was the closest official weather station to the accident site located 4 miles east of New York City, New York, and had an Automated Surface Observing System (ASOS<sup>2</sup>) whose reports were supplemented by an official human observer. KLGA was located 7 miles northeast of the accident site, at an elevation of 21 feet, and had a 12° westerly magnetic variation<sup>3</sup> (figure 7). The following observations were taken and disseminated during the times surrounding the accident<sup>4</sup>:

[0151 EST] KLGA 090651Z 0000KT 10SM FEW100 05/M03 A3037 RMK AO2  
SLP285 T00501028=

[0251 EST] KLGA 090751Z 0000KT 9SM SCT055 SCT250 04/M02 A3038  
RMK AO2 SLP285 T00441022=

[0351 EST] KLGA 090851Z 0000KT 8SM BKN055 04/M01 A3036 RMK AO2  
SLP282 T00391006 56008=

[0451 EST] KLGA 090951Z 0000KT 9SM BKN050 04/M02 A3036 RMK AO2  
SLP280 T00441022=

[0551 EST] KLGA 091051Z 05004KT 7SM FEW050 SCT250 03/M01 A3036  
RMK AO2 SLP280 T00331006=

**[0651 EST] KLGA 091151Z 06005KT 7SM BKN048 03/01 A3037 RMK AO2  
SLP282 T00330006 10056 20022 53000=**

<sup>2</sup> ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, ceiling, temperature, dewpoint, altimeter, and barometric pressure.

<sup>3</sup> Magnetic variation – The angle (at a particular location) between magnetic north and true north.

<sup>4</sup> The bold sections in this NWS product and the rest of products in the weather study report are to highlight the individual sections that directly reference the weather conditions that are or will affect the accident location around the accident time.

**[0751 EST] KLGA 091251Z 07004KT 5SM BR FEW048 BKN250 03/01 A3038  
RMK AO2 SLP287 T00280006=**

**ACCIDENT TIME 0841 EST**

**[0851 EST] KLGA 091351Z 00000KT 6SM HZ FEW042 OVC250 04/01 A3038  
RMK AO2 SLP288 T00390006=**

[0951 EST] KLGA 091451Z 00000KT 5SM HZ OVC240 07/01 A3037 RMK  
AO2 SLP284 T00670011 50002=

[1051 EST] KLGA 091551Z 16008KT 10SM FEW190 OVC240 08/00 A3031  
RMK AO2 SLP264 T00830000=

[1151 EST] KLGA 091651Z 19007KT 10SM FEW170 OVC210 08/01 A3028  
RMK AO2 SLP254 T00830006=

KLGA weather at 0651 EST, wind from 060° at 5 knots, 7 miles visibility, a broken ceiling at 4,800 feet above ground level (agl), temperature of 3° Celsius (C), dew point temperature of 11° C, and an altimeter setting of 30.37 inches of mercury. Remarks: automated station with a precipitation discriminator, sea-level pressure 1028.2 hPa, temperature 3.3° C, dew point temperature 0.6° C, 6-hourly maximum temperature of 5.6° C, 6-hourly minimum temperature of 2.2° C.

KLGA weather at 0751 EST, wind from 070° at 4 knots, 5 miles visibility and mist, few clouds at 4,800 feet agl, a broken ceiling at 25,000 feet agl, temperature of 3° C, dew point temperature of 1° C, and an altimeter setting of 30.38 inches of mercury. Remarks: automated station with a precipitation discriminator, sea-level pressure 1028.7 hPa, temperature 2.8° C, dew point temperature 0.6° C.

KLGA weather at 0851 EST, wind calm, 6 miles visibility and haze, few clouds at 4,200 feet agl, an overcast ceiling at 25,000 feet agl, temperature of 4° C, dew point temperature of 1° C, and an altimeter setting of 30.38 inches of mercury. Remarks: automated station with a precipitation discriminator, sea-level pressure 1028.8 hPa, temperature 3.9° C, dew point temperature 0.6° C.

Newark Liberty International Airport (KEWR) was the next closest airport to the accident site located 3 miles south of Newark, New Jersey, and KEWR had an ASOS whose reports were supplemented by an official human observer. KEWR is at an elevation of 18 feet, had a 13° westerly magnetic variation, and was located 7 miles west of the accident site (figure 7). The following observations were taken and disseminated during the times surrounding the accident:

[0351 EST] KEWR 090851Z 00000KT 10SM BKN055 OVC250 02/M01 A3037  
RMK AO2 SLP284 T00221011 56007=

[0451 EST] KEWR 090951Z 00000KT 10SM BKN050 OVC250 02/M02 A3037  
RMK AO2 SLP282 T00221017=

[0551 EST] KEWR 091051Z 00000KT 9SM FEW050 SCT250 02/M02 A3036  
RMK AO2 SLP280 T00171017=

**[0651 EST] KEWR 091151Z 00000KT 9SM BKN045 BKN250 02/M02 A3037  
RMK AO2 SLP284 T00171017 10028 20006 55000=**

**[0751 EST] KEWR 091251Z 26004KT 6SM BR BKN040 BKN250 01/M01 A3039  
RMK AO2 SLP290 T00111011=**

**ACCIDENT TIME 0841 EST**

**[0851 EST] KEWR 091351Z 00000KT 7SM FEW040 BKN240 03/M01 A3038  
RMK AO2 SLP287 HAZE ALOFT VIS LWR NE-S T00281006=**

[1555 EST] KEWR 091451Z 00000KT 7SM FEW200 OVC240 06/00 A3037  
RMK AO2 SLP283 HAZE ALOFT VIS LWR NE-S T00560000 58001=

[1615 EST] KEWR 091551Z 17003KT 7SM OVC240 07/01 A3031 RMK AO2  
SLP264 HAZE ALOFT VIS LWR NE-S T00670006=

[1635 EST] KEWR 091651Z 23005KT 7SM FEW180 OVC230 08/01 A3030  
RMK AO2 SLP259 HAZE ALOFT VIS LWR NE-S T00830011=

KEWR weather at 0651 EST, wind calm, 9 miles visibility, a broken ceiling at 4,500 feet agl, broken skies at 25,000 feet agl, temperature of 2° C, dew point temperature of -2° C, and an altimeter setting of 30.37 inches of mercury. Remarks: automated station with a precipitation discriminator, sea-level pressure 1028.4 hPa, temperature 1.7° C, dew point temperature -1.7° C, 6-hourly maximum temperature of 2.8° C, 6-hourly minimum temperature of 0.6° C.

KEWR weather at 0751 EST, wind from 260° at 4 knots, 6 miles visibility and mist, a broken ceiling at 4,000 feet agl, broken skies at 25,000 feet agl, temperature of 1° C, dew point temperature of -1° C, and an altimeter setting of 30.39 inches of mercury. Remarks: automated station with a precipitation discriminator, sea-level pressure 1029.0 hPa, temperature 1.1° C, dew point temperature -1.1° C.

KEWR weather at 0851 EST, wind calm, 7 miles visibility, few clouds at 4,000 feet agl, an overcast ceiling at 24,000 feet agl, temperature of 3° C, dew point temperature of -1° C, and an altimeter setting of 30.38 inches of mercury. Remarks: automated station with a precipitation discriminator, sea-level pressure 1028.7 hPa, haze aloft with visibility lower to the northeast through south, temperature 2.8° C, dew point temperature -0.6° C.

### 3.0 Upper Air Data

The closest official upper air sounding to the accident site was from Upton, New York (KOKX), which was approximately 53 miles east of the accident site, with a site number 72501, and a station elevation of 66 feet. The 0700 EST sounding from KOKX was plotted on a standard Skew-T log P diagram<sup>5</sup>, which is presented along with the derived stability parameters in figure 8 (with data from the surface to 300-hPa, or approximately 30,000 feet msl). This data was analyzed utilizing the RAOB<sup>6</sup> software package. The sounding depicted a dry vertical environment with the Lifted Condensation Level (LCL)<sup>7</sup> at 783 feet msl and a Convective Condensation Level (CCL)<sup>8</sup> of 16,542 feet. The freezing level was identified at 4,528 feet. The precipitable water value was 0.35 inches.

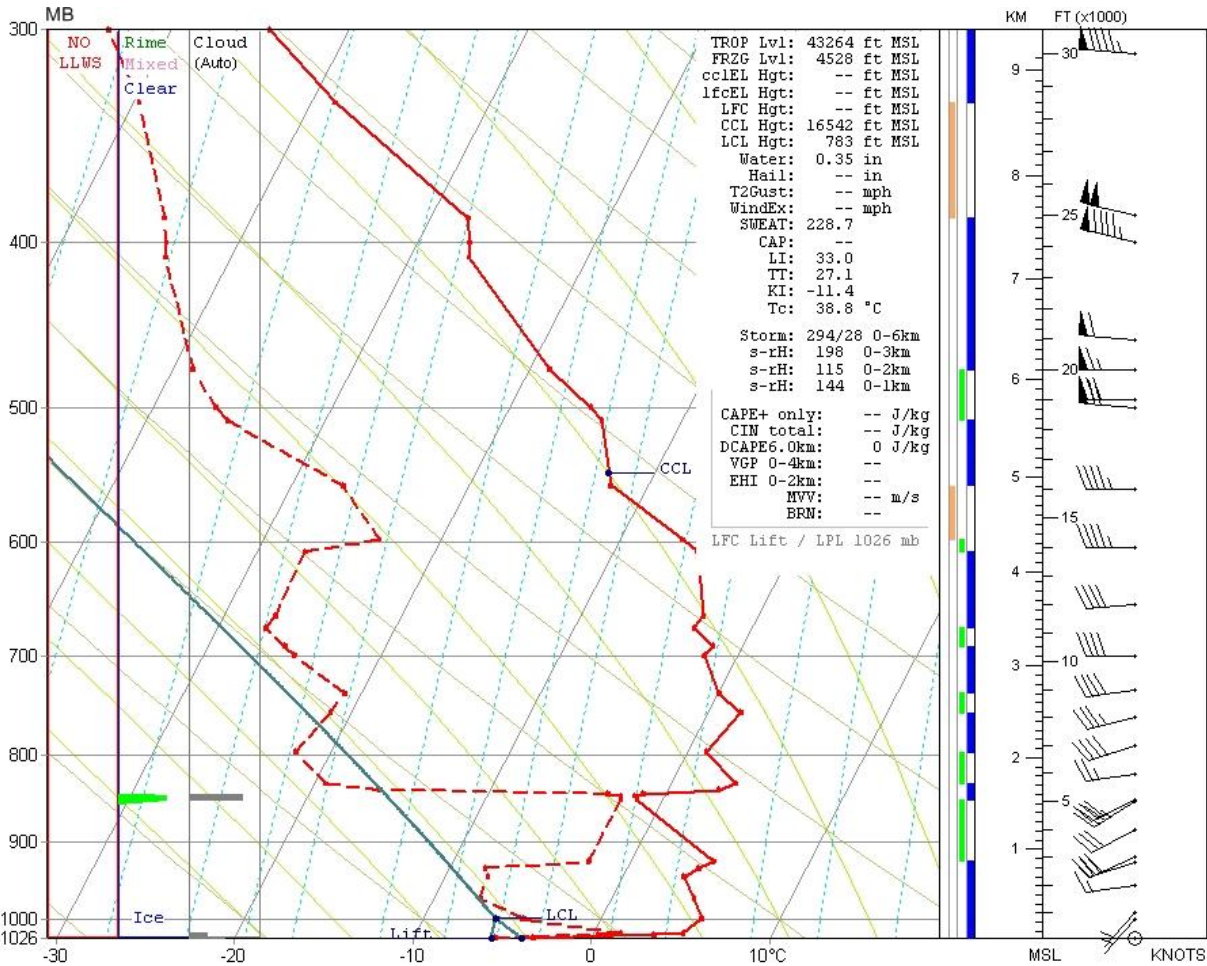
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<sup>5</sup> Skew T log P diagram – is a standard meteorological plot using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

<sup>6</sup> RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

<sup>7</sup> Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

<sup>8</sup> Convective Condensation Level (CCL) – The level in the atmosphere to which an air parcel, if heated from below, will rise dry adiabatically, without becoming colder than its environment just before the parcel becomes saturated.



**Figure 8 – 0700 EST KOKX upper air sounding**

The 0700 EST KOKX sounding indicated a dry stable vertical environment, with the exception of more unstable layers from 15,000 feet msl and above. The vertical environment was not moist with the exception of near 6,000 feet where RAOB identified a high probability of clouds. RAOB identified a small probability of icing near 6,000 feet with another small probability of cloud cover near the surface.

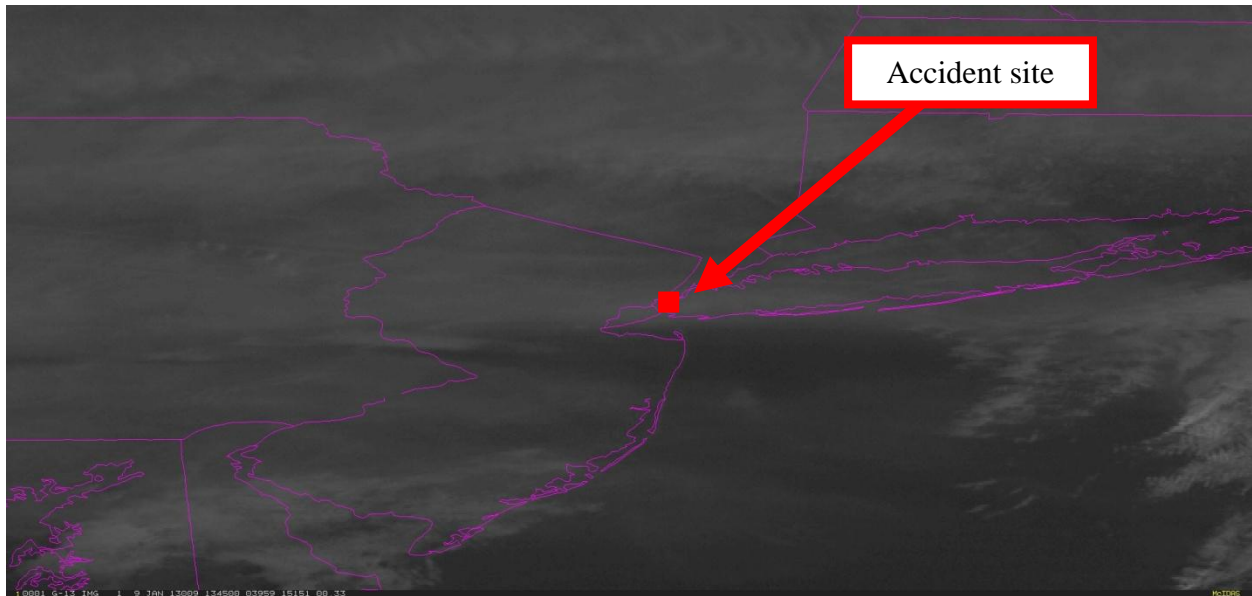
The sounding wind profile indicated there was a calm surface wind with the wind veering<sup>9</sup> with height and increasing in speed to westerly near 100 knots around 25,000 feet. No low-level wind shear (LLWS) was indicated by RAOB.

<sup>9</sup> Veering wind – Wind which changes in a clockwise direction with time at a given location, or which changes direction in a clockwise sense with height.

#### 4.0 Satellite Data

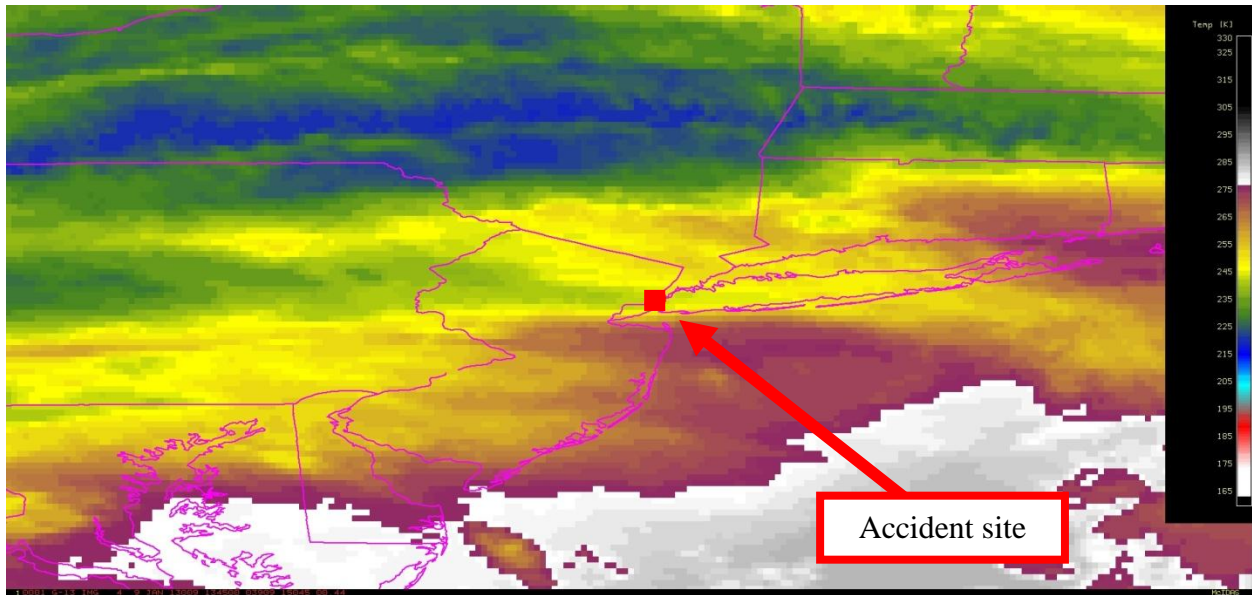
Visible and infrared data from the Geostationary Operational Environmental Satellite number 13 (GOES-13) data was obtained from the NCDC and processed with the NTSB's Man-computer Interactive Data Access System (McIDAS) workstation. Visible and infrared imagery (GOES-13 band 1 and 4) at a wavelength of 0.65 microns ( $\mu\text{m}$ ) and 10.7  $\mu\text{m}$  retrieved brightness temperatures for the scene. Satellite imagery surrounding the time of the accident, from 0600 EST through 1000 EST at approximately 15-minute intervals, were reviewed and the closest images to the time of the accident are documented here.

Figure 9 presents the GOES-13 visible imagery from 0845 EST, at 3X magnification with the accident site highlighted with a red square. The visible imagery indicated a large amount of cloud cover at and around the accident site at the accident time. Figure 10 presents the GOES-13 infrared imagery from 0845 EST at 9X magnification. Inspection of the infrared imagery indicated a band of clouds stretched from west to east across the accident site and into eastern Pennsylvania with a brightness temperature near 243 Kelvin around the accident time. Based on the brightness temperatures above the accident site and the vertical temperature profile provided by the 0700 EST KOKX sounding (figure 8), the approximate cloud-top heights over the accident site were 26,000 feet at 0845 EST.



**Figure 9 – GOES-13 visible image at 0845 EST**





**Figure 10 – GOES-13 infrared image at 0845 EST**

## 5.0 Radar Imagery Information

The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D) was KOKX. Level II archive radar data was obtained from the NCDC utilizing the NEXRAD Data Inventory Search and displayed using the NOAA’s Weather and Climate Toolkit software.

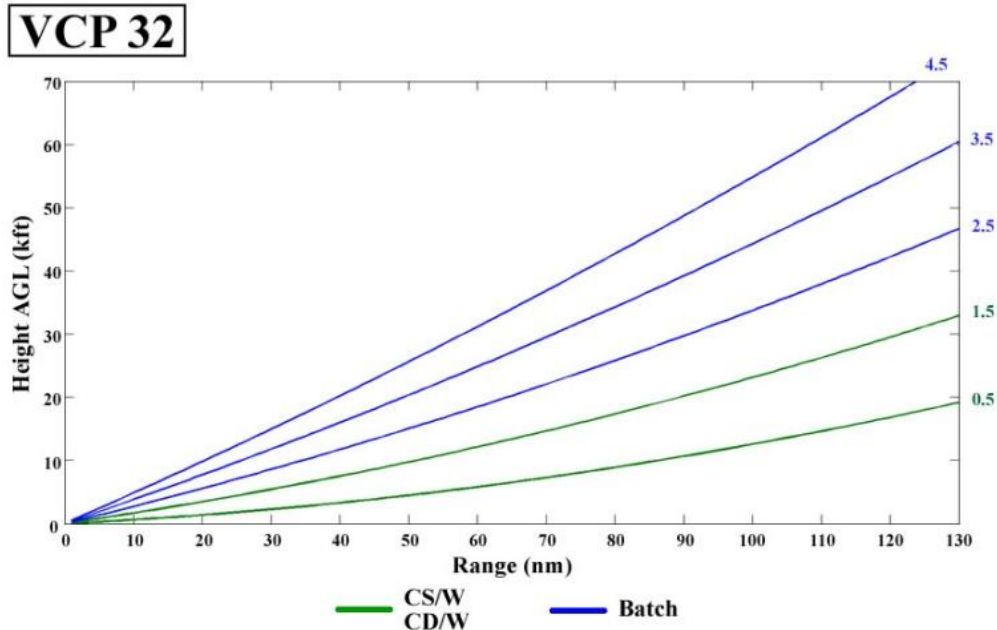
The WSR-88D is an S-band 10-centimeter wavelength radar with a power output of 750,000 watts, and with a 28-foot parabolic antenna that concentrates the energy between a 0.87° and 0.96° beam width<sup>10</sup>. The radar produces three basic types of products: base reflectivity, base radial velocity, and base spectral width.

### 5.1 Volume Scan Strategy

The WSR-88D is a computer-controlled radar system, which automatically creates a complete series of specific scans in a specific sequence known as a volume scan. Individual elevation scans are immediately available on the WSR-88D’s Principle Users Processor (PUP). Products that require data from multiple elevation scans are not available until the end of the five to ten minute volume scan.

<sup>10</sup> Beam width – A measure of the angular width of a radar beam.

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has two common scanning strategies. The most common is where the radar makes 9 elevation scans from 0.5° to 19.5° every six minutes. This particular scanning strategy is documented as volume coverage pattern 21 (VCP-21). Mode B is the clear-air mode, where the radar makes 5 elevation scans during a ten minute period and is documented as VCP 32. During the period surrounding the accident, the KOKX WSR-88D radar was operating in the clear-air mode (Mode B, VCP-32). The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.



VCP-32 Precipitation Mode Scan Strategy

## 5.2 Beam Height Calculation

Assuming standard refraction<sup>11</sup> of the WSR-88D 0.95° wide radar beam, the following table shows the approximate beam height and width information<sup>12</sup> of the radar display over the site of the accident. The heights have been rounded to the nearest 10 feet.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP	BEAM WIDTH
0.5°	4,930 feet	2,320 feet	7,550 feet	5,230 feet

Based on the radar height calculations, the 0.5° elevation scan depicted the conditions between 2,320 feet and 7,550 feet msl over the accident site.

<sup>11</sup> Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

<sup>12</sup> Beamwidth values are shown for legacy resolution products. Super resolution products would an effective beamwidth that would be approximately half these values.

### 5.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors<sup>13</sup> it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ<sup>14</sup>), and is a general measure of echo intensity. The chart below relates the NWS video integrator and processor (VIP) intensity levels versus the WSR-88D's display levels, precipitation mode reflectivity in decibels, and rainfall rates.

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<sup>13</sup> Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth's surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glazed ice.

<sup>14</sup> dBZ – A non-dimensional “unit” of radar reflectivity which represents a logarithmic power ratio (in decibels , or dB) with respect to radar reflectivity factor, Z.

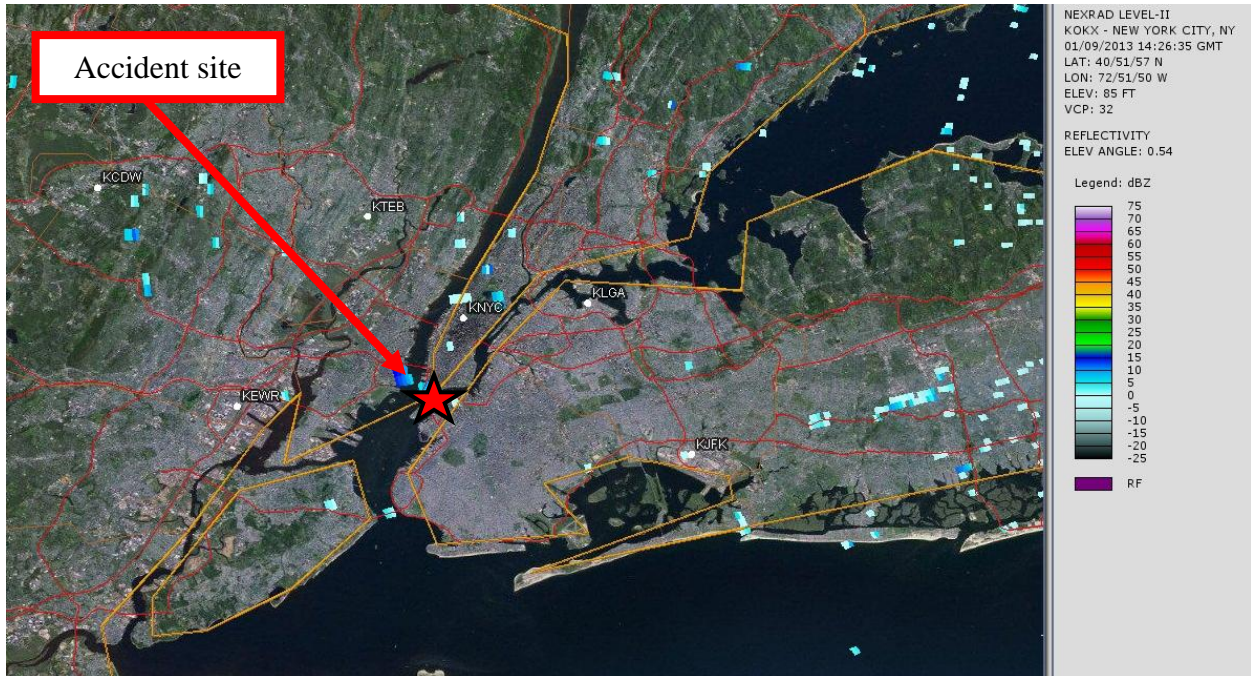
## NWS VIP/DBZ CONVERSION TABLE

NWS VIP	WSR-88D LEVEL	PREC MODE DBZ	RAINFALL
0	0	< 5	
	1	5 to 9	
	2	10 to 14	
1 Very Light	3	15 to 19	.01 in/hr
	4	20 to 24	.02 in/hr
	5	25 to 29	.04 in/hr
2 Light to Moderate	6	30 to 34	.09 in/hr
	7	35 to 39	.21 in/hr
3 Strong	8	40 to 44	.48 in/hr
4 Very Strong	9	45 to 49	1.10 in/hr
5 Intense	10	50 to 54	2.49 in/hr
6 Extreme	11	55 to 59	>5.67 in/hr
	12	60 to 64	
	13	65 to 69	
	14	70 to 74	
	15	> 75	

The Federal Aviation Administration (FAA) Advisory Circular AC 00-24B titled “Thunderstorms” dated January 2, 1983, also defines the echo intensity levels and potential weather phenomena associated with those levels. If the maximum VIP Level is 1 “weak” and 2 “moderate”, then light to moderate turbulence is possible with lightning. VIP Level 3 is “strong” and severe turbulence is possible with lightning. VIP Level 4 is “very heavy” and severe turbulence is likely with lightning. VIP Level 5 is “intense” with severe turbulence, lightning, hail likely, and organized surface wind gusts. VIP Level 6 is “extreme” with severe turbulence, lightning, large hail, extensive surface wind gusts and turbulence.

### 5.4 Base Reflectivity and Lightning Data

Figure 11 presents the KOKX WSR-88D base reflectivity image for the 0.5° elevation scans initiated at 0827 EST with a resolution of 0.5° X 250 m. The KOKX WSR-88D shows no weather radar targets over the accident site near the accident time. No lightning was reported or detected near the accident site at the accident time.



**Figure 11 – KOKX WSR-88D reflectivity for the 0.5° elevation scan initiated at 0827 EST**

## 6.0 Terminal Aerodrome Forecast

KLGA (figure 7) was the closest site with a NWS TAF. The TAF valid at the time of the accident was issued at 0631 EST and was valid for a 24-hour period beginning at 0700 EST. The TAF forecast for KLGA was as follows:

```
KLGA 091131Z 0912/1012 VRB03KT P6SM BKN050
FM091400 22006KT P6SM BKN050
FM091900 23010KT P6SM SCT050 SCT100
FM092200 24013G22KT P6SM SCT100
FM100500 30016G25KT P6SM SKC=
```

The forecast expected a variable wind at 3 knots, visibility greater than 6 miles, a broken ceiling at 5,000 feet agl.

## 7.0 Area Forecast

The Area Forecast issued at 0445 EST, and valid at the accident time, forecasted scattered clouds between 3,500 and 5,000 feet msl, and scattered cirrus clouds aloft:

```
FAUS41 KPCI 090945
FA1W
_BOSC FA 090945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 100400
CLDS/WX VALID UNTIL 092200...OTLK VALID 092200-100400
ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS
.
```

SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.  
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.  
NON MSL HGTS DENOTED BY AGL OR CIG.

.  
SYNOPSIS...NO SGFNT FNTL SYS IN AREA. CDFNT OVR WRN PTNS OF UPR  
GRTLKS RGN WILL MOVE RPDLY SEWD TOWARDS AREA DURG PD. BY 04Z...  
STG LOW PRES SYS WILL BE JUST E OF ME IN NB. CDFNT WILL CURVE  
FROM LOW INTO THE ATLC. HIGH PRES WILL BE ALG THE IN-OH BRDR.

.  
ME NH VT  
SCT035-050 SCT CI. OCNL VIS 3-5SM BR ENDG BY 13Z. BECMG 1922  
BKN050 OVC100 LYRD TO FL200. ISOL -SHSN DVLPG. OTLK...VFR SHSN.

.  
MA RI CT  
SCTCI. OCNL VIS 3-5SM BR ENDG 13Z-15Z. OTLK...VFR.

.  
NY LO  
NERN NY...SCT CI. OCNL VIS 3SM BR. BECMG 1619 BKN050 BKN-OVC100  
LYRD FL200. WIND SW 20G30KT. OTLK...VFR BECMG 2201 MVFR CIGS  
SHSN.  
WRN NY/LO...SCT-BKN CI. BECMG 1619 BKN080-100 LYRD FL200. WIND  
SW 20G35KT. OTLK...VFR WIND.  
**SERN NY...SCT035-050 SCT CI. BECMG 1922 BKN050 BKN100 LYRD FL200.  
OTLK...VFR.**

.  
PA NJ  
WRN AND CNTRL PA...BKN CI. BECMG 1316 OVC080-100 LYRD FL200.  
BECMG 1619 BKN050. OTLK...VFR.  
ERN PA/NJ...SCT-BKN035-050 BKN CI. OCNL VIS 3-5SM BR. BECMG 1922  
BKN050 BKN080-100 LYRD FL200. OTLK...VFR.

.  
OH LE  
BKN-OVC080-100 LYRD FL200. OVC CI. BECMG 1316 OVC035-050 LYRD  
FL200. WDLY SCT -SHRA DVLPG. BECMG 1922 SCT100 BKN CI.  
OTLK...VFR.

.  
WV  
SERN WV...BKN CI. BECMG 1316 BKN-OVC035 TOPS 080-100. BKN CI.  
OTLK...MVFR CIGS.  
REST OF WV...SCT050 BKN100 LYRD TO FL200. OTLK...VFR.

.  
VA MD DC DE  
SWRN VA...BKN030. TOPS 080-100. OCNL VIS 3-5SM BR TIL 16Z.  
OTLK...MVFR CIGS.  
NRN VA/WRN AND NRN MD/DC/DE...SCT150 BKN CI. OTLK...VFR.  
SERN VA/SERN MD...BKN-SCT035-050. TOPS 060-080. OTLK...VFR.

.  
CSTL WTRS  
NRN NEW ENG CSTL WTRS...BKN CI. OTLK...VFR.  
SRN NEW ENG/MID ATLC CSTL WTRS...BKN050 BKN080-100 TOPS 120-140.  
OTLK...VFR.

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## 8.0 National Weather Service Area Forecast Discussion

The National Weather Service Office in New York City, New York, issued the following Area Forecast Discussion at 0643 EST which discussed no visibility restrictions to area terminals within the city, and the winds were not expected to increase until after cold front passage later on in the day:

FXUS61 KOKX 091143

AFDOKX

AREA FORECAST DISCUSSION

NATIONAL WEATHER SERVICE NEW YORK NY

643 AM EST WED JAN 9 2013

.SYNOPSIS...

HIGH PRESSURE OVER THE AREA MOVES OFF SHORE THIS MORNING AS LOW PRESSURE TRACKS THROUGH SOUTHERN CANADA. THIS LOW WILL BRING A COLD FRONT THROUGH THE REGION THIS EVENING. HIGH PRESSURE BUILDS IN BEHIND THE FRONT TONIGHT THROUGH THURSDAY. THE HIGH MOVES OFFSHORE THURSDAY NIGHT. A WARM FRONT MOVES IN FROM THE SOUTH AND WEST ON FRIDAY. A COLD FRONT THEN MOVES ACROSS FRIDAY NIGHT. WEAK HIGH PRESSURE BUILDS ALONG THE EASTERN SEABOARD FOR THE WEEKEND. BY THE END OF THE WEEKEND...ANOTHER COLD FRONT WILL BE APPROACHING FROM THE WEST. THIS WILL BE MOVING ACROSS BY EARLY MONDAY. HOWEVER...THE FRONT WILL BECOME NEARLY STATIONARY TO THE SOUTH OF THE REGION WITH THE EVENTUAL FRONT REGAINING MOVEMENT TO THE NORTH AS A WARM FRONT BY MONDAY NIGHT AND TUESDAY.

&&

.NEAR TERM /UNTIL 6 PM THIS EVENING/...

SPS REMAINS IN EFFECT FOR AREAS OF BLACK ICE THIS MORNING UNTIL 14-15Z. OTHERWISE...MINOR ADJUSTMENTS FOR TEMPS AND DEWPOINTS AS WELL AS CLOUD COVERAGE WERE MADE FOR THE NEXT FEW HOURS. OTHER THAN THAT...REST OF FORECAST WAS NOT CHANGED.

RIDGE WEAKENS THROUGH TODAY AS NORTHERN STREAM UPPER TROUGH MOVES INTO THE NORTHERN STATES. AT THE SURFACE HIGH PRESSURE MOVES WELL OFF SHORE AS LOW PRESSURE MOVES NORTH OF THE GREAT LAKES. WARM ADVECTION AND A DEEP WESTERLY FLOW WILL ALLOW TEMPERATURES TO ONCE AGAIN CLIMB ABOVE SEASONAL NORMALS...DESPITE MORE CLOUDINESS. HAVE LEANED TOWARD THE WARMER NAM AND ECMWF GUIDANCE FOR HIGHS.

&&

.SHORT TERM /6 PM THIS EVENING THROUGH 6 PM THURSDAY/...

MOISTURE IS LIMITED WITH THE COLD FRONT SET TO MOVE THROUGH THE AREA EARLY THIS EVENING...10/00Z TO 10/03Z...AND BEST LIFT AND VORT TO THE NORTH OF THE AREA...SO WILL KEEP POPS AT ZERO. ALTHOUGH WOULD NOT BE TOO SURPRISED IF A FEW DROPS FALL AT KSWF AND KMGJ. AIR IS NOT THAT COLD BEHIND THE FRONT AND BEST COLD ADVECTION LIMITED TO TONIGHT. NAM IS HOLDING ON TO RATHER STRONG LOW LEVEL INVERSION AND LIMITS MIXING BEHIND THE FRONT WHILE THE GFS LOOKS TO BE OVERDONE. WILL SEE A BRIEF INCREASE IN WINDS AND GUSTS WITH THE ONSET OF THE COLDER AIR BEHIND THE FRONT. FOR LOWS LEANED AGAIN TOWARD THE WARMER NAM AND ECMWF GUIDANCE.

HEIGHTS BUILDS THROUGH THE DAY THURSDAY AS UPPER RIDGE BUILDS FROM THE SOUTHEAST INTO SOUTHERN CANADA...AND AT THE SURFACE HIGH PRESSURE BUILDS QUICKLY TOWARD THE AREA. WEAK WARM ADVECTION AND/OR A MODIFYING AIRMASS WILL KEEP TEMPERATURES ABOVE SEASONAL NORMALS AGAIN THURSDAY. USED THE WARM NAM FOR HIGHS.

&&

.LONG TERM /THURSDAY NIGHT THROUGH TUESDAY/...

OVERALL LOOKING AT THE LARGE SCALE...THURSDAY NIGHT THROUGH SATURDAY WILL FEATURE A STRENGTHENING UPPER LEVEL RIDGE ACROSS THE EASTERN U.S AND PERSISTENT TROUGHING IN THE SOUTHWEST U.S. THE RIDGE WILL FLATTEN AND SHIFT FARTHER OFFSHORE SATURDAY NIGHT INTO EARLY NEXT WEEK. THERE WILL BE AN EMBEDDED LOW AMPLITUDE SHORTWAVE ON THE BACKSIDE OF THE RIDGE MOVING INTO THE OHIO VALLEY ON FRIDAY WITH WARM AIR ADVECTION ALOFT TAKING PLACE IN OUR LOCAL REGION GOING INTO FRIDAY MORNING AND CONTINUING THROUGH THE DAY.

AT THE SURFACE...HIGH PRESSURE ACROSS THE REGION THURSDAY EVENING WILL MOVE OFFSHORE ON FRIDAY. A WARM FRONT WILL BE MOVING INTO THE REGION AS WELL ALTHOUGH WITH THE WEAK DYNAMICS IN PLACE AND THE OVERALL GREATER SIGNAL OF THE RIDGE LOOKING AT THE LARGER SCALE...THIS IS NOT SHOWING MUCH PRECIPITATION ASSOCIATED WITH IT. MODELS HAVE TRENDED BACK THE TIMING OF THE PRECIP COMPARED TO A FEW DAYS AGO WITH THE GFS SHOWING THE FASTER ONSET OF PRECIP. WITH THE CHANGE IN TIMING TO MAINLY DAYTIME AND EVENING ON FRIDAY...EXPECTING MAINLY A RAIN EVENT AND NOT THAT MUCH IN TERMS OF RAINFALL AMOUNTS. THE PARENT LOW IS WAY BACK IN THE NORTH CENTRAL U.S. WITH A WEAKENING LOW IN THE GREAT LAKES. IF TIMING TURNS OUT TO BE EARLIER TOWARDS EARLY FRIDAY MORNING...THERE WILL STILL BE THE POSSIBILITY FOR SOME FREEZING RAIN ACROSS SOME INTERIOR LOCATIONS WITH WARM AIR ALOFT AND SFC TEMPS FREEZING OR BELOW.

UPPER LEVEL RIDGE AXIS BUILDS INTO REGION ON SATURDAY AND BEGINS TO FLATTEN SATURDAY NIGHT AND SUNDAY. HIGH PRESSURE WILL REBUILD ACROSS THE EASTERN SEABOARD BUT WILL BE RATHER WEAK FOR SATURDAY AND SATURDAY NIGHT WITH DRY WEATHER EXPECTED. THE LOW IN THE NORTH CENTRAL U.S. WILL BE MAKING ITS WAY INTO NORTHERN QUEBEC BY SUNDAY AND DEEPENING WITH AN ASSOCIATED COLD FRONT APPROACHING THE REGION. THE PROGRESSION OF FEATURES WILL BE A LITTLE SLOWER WITH THE RIDGING STILL IN PLACE ACROSS THE REGION. HOWEVER...EXPECTING A MORE UNSETTLED WEATHER PATTERN TO EVENTUALLY DEVELOP AS THIS COLD FRONT DRAWS CLOSER ALONG WITH THE CLOSER PROXIMITY OF THE UPPER LEVEL SOUTHWESTERLY JET OF ABOUT 130-170 KT WITH THE GFS BEING ON THE WEAKER SIDE AND ECMWF AND CMC ON THE STRONGER SIDE WITH RESPECT TO THE JET.

THE COLD FRONT LOOKS TO APPROACH ON SUNDAY AND MOVE ACROSS BY EARLY MONDAY. THE FRONT THEN IS FORECAST TO BECOME NEARLY STATIONARY TO THE SOUTH OF THE REGION AND EVENTUALLY LIFT BACK NORTH AS A WARM FRONT LATE MONDAY AND TUESDAY. THERE WILL BE A SLIGHT CHANCE OF SHOWERS ON SUNDAY WITH ECMWF SHOWING MOST PRECIP TO THE NORTH OF THE REGION WITH THE GFS AND ITS ENSEMBLE KEEPING PRECIP TO THE NORTH AND WEST OF THE FORECAST REGION. THE GFS...ECMWF...AND CMC ARE EXHIBITED A LULL IN THE PRECIP FOR SUNDAY NIGHT INTO EARLY MONDAY BUT WITH THE UNCERTAINTY AND RUN TO RUN FLUCTUATIONS...KEPT THE SLIGHT CHANCE OF SHOWERS AND INCREASED IT TOWARDS MONDAY WHEN THE FRONT WILL BE MOVING INTO THE REGION WITH A CHANCE OF SHOWERS THEREAFTER WITH THE FRONTAL BOUNDARY STAYING NEARBY.

TEMPERATURES THROUGH THE LONG TERM ARE IN MID TO UPPER 40S FOR HIGHS ON FRIDAY WITH UPPER 40S TO LOW TO MID 50S FOR HIGHS DURING THE WEEKEND. A GENERAL COOLING TREND TO TEMPS FORECAST THEREAFTER.

&&

.AVIATION /12Z WEDNESDAY THROUGH SUNDAY/...

**GENERALLY VFR WITH HIGH PRESSURE OVER THE WESTERN ATLANTIC AND A COLD FRONT APPROACHING FROM THE GREAT LAKES REGION. THIS WILL RESULT IN A MANLY SW FLOW...WHICH GRADUALLY RAMPS UP THIS AFTERNOON.**



SOME PATCHY EARLY MORNING GROUND FOG ACROSS OUTLYING TERMINALS WITH MVFR CONDS. THAT FOG WILL LIFT AND VFR EXPECTED THROUGHOUT BY 14Z. COLD FRONT MOVES ACROSS TERMINALS DURING THE LATE AFTERNOON AND EARLY EVENING HOURS. ONLY MID AND HIGH LEVEL CLOUDS ARE FORECAST TO PRECEDE AND ACCOMPANY THE FRONTAL BOUNDARY. GUSTS UP TO 20 KT POSSIBLE JUST AHEAD OF FRONT.

WIND GUSTS TONIGHT BEHIND THE COLD FRONT WILL RANGE FROM 20-25 KT. WINDS SHOULD GRADUALLY DIMINISH THROUGH THE OVERNIGHT HOURS.

...NY METRO ENHANCED AVIATION WEATHER SUPPORT...

DETAILED INFORMATION...INCLUDING HOURLY TAF WIND COMPONENT FCSTS CAN BE FOUND AT: [HTTP://WWW.ERH.NOAA.GOV/ZNY/N90](http://www.erh.noaa.gov/zny/n90) (LOWER CASE)

KEWR FCSTER COMMENTS: NO UNSCHEDULED AMENDMENTS EXPECTED.

THE AFTERNOON KEWR HAZE POTENTIAL FORECAST IS GREEN...WHICH IMPLIES SLANT RANGE VISIBILITY 7SM OR GREATER OUTSIDE OF CLOUD.

KJFK FCSTER COMMENTS: NO UNSCHEDULED AMENDMENTS EXPECTED.

KLGA FCSTER COMMENTS: NO UNSCHEDULED AMENDMENTS EXPECTED.

KTEB FCSTER COMMENTS: NO UNSCHEDULED AMENDMENTS EXPECTED.

KHPN FCSTER COMMENTS: NO UNSCHEDULED AMENDMENTS EXPECTED.

KISP FCSTER COMMENTS: NO UNSCHEDULED AMENDMENTS EXPECTED.

.OUTLOOK FOR 12Z THURSDAY THROUGH SUNDAY...

.THU...VFR. WND NW 10-15 KT. GUSTS UP TO 20 KT POSSIBLE IN THE AM.

.FRI...CONDITIONS LOWERING. POTENTIAL IFR IN AFTN WITH -RA.

.SAT...VFR.

.SUN...VFR.

&&

.MARINE...

HIGH PRESSURE EAST OF THE FORECAST WATERS MOVES FARTHER EAST AS A LOW PRESSURE SYSTEM ACROSS SOUTH CENTRAL CANADA TRACKS EAST TODAY AND TONIGHT. THIS LOW WILL BRING A COLD FRONT ACROSS THE FORECAST WATERS THIS EVENING. **WEST TO SOUTHWEST WINDS WILL INCREASE THROUGH THE DAY AS THE LOW TRACKS EAST. WITH LIMITED MIXING OVER THE WATERS WIND GUSTS ARE EXPECTED TO REMAIN BELOW SMALL CRAFT LEVELS THROUGH TODAY.** SEAS WILL ALSO REMAIN BELOW SMALL CRAFT LEVELS.

AFTER THE PASSAGE OF THE COLD FRONT THIS EVENING WINDS AND GUSTS WILL INCREASE IN THE COLD ADVECTION. GUSTS WILL REACH SMALL CRAFT LEVELS FOR SEVERAL HOURS BEHIND THE FRONT ACROSS MUCH OF THE AREA...AND GALE FORCE WIND GUSTS ARE LIKELY ACROSS THE EASTERN SOUND...PECONIC BAY AND THE OCEAN WATERS EAST OF MORICHES INLET. WINDS ON THE GFS AND ECMWF WERE HIGHER THAN THE NAM AND MIXING WAS MUCH DEEPER THAN THE NAM. HOWEVER THE NAM DID HOLD ON TO A DEEP INVERSION AND LIMITED THE MIXING ON THE WATERS TOO MUCH. WILL BE SEVERAL HOURS OF GALE GUSTS FROM AROUND 03Z TO 09Z. WINDS WILL QUICKLY DIMINISH AS THE HIGHER LOW LEVEL WINDS SHIFT EAST AND THE COLD ADVECTION WEAKENS. BY 12Z THURSDAY MORNING GUSTS WILL LIKELY BE BELOW SMALL CRAFT ON MOST OF THE WATERS AND SMALL CRAFT GUSTS MAY REMAIN A FEW HOURS ON THE EASTERN OCEAN ZONE...AS WILL SEAS.

HAVE UPGRADED THE GALE WATCH TO A WARNING FOR TONIGHT FOR THE EASTERN SOUND...PECONIC BAY...AND THE OCEAN EAST OF MORICHES INLET...AND KEPT THE SMALL CRAFT JUST FOR TONIGHT ON THE REMAINDER OF THE WATERS.

WITH HIGH PRESSURE BUILDING IN THURSDAY BY MID MORNING WINDS AND SEAS WILL BE BELOW SMALL CRAFT LEVELS THROUGH THE REST OF THE DAY. MAGNITUDE OF PRESSURE AREAS NEAR THE FORECAST WATERS WILL NOT BE THAT STRONG FOR THURSDAY NIGHT THROUGH THE WEEKEND...HENCE A LOWERED PRESSURE GRADIENT. CONDITIONS ARE EXPECTED TO REMAIN BELOW SCA THROUGH THIS PERIOD.

&&

.HYDROLOGY...

NO PRECIPITATION IS EXPECTED THROUGH THURSDAY.

WITH THE PRECIPITATION WHICH SHOULD BE MAINLY RAIN FOR FRIDAY AND FRIDAY NIGHT...QPF LOOKS TO BE AROUND A QUARTER OF AN INCH OR LESS FROM MOST MODEL GUIDANCE.

&&

.OKX WATCHES/WARNINGS/ADVISORIES...

CT...NONE.

NY...NONE.

NJ...NONE.

MARINE...SMALL CRAFT ADVISORY FROM 6 PM THIS EVENING TO 6 AM EST

THURSDAY FOR ANZ335-338-345-353-355.

GALE WARNING FROM 6 PM THIS EVENING TO 6 AM EST THURSDAY FOR

ANZ330-340-350.

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## 9.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for the accident site on January 9, 2013, indicated the following:

### SUN

Begin civil twilight 0649 EST

Sunrise 0720 EST

Sun transit 1203 EST

Sunset 1647 EST

End civil twilight 1718 EST

## F. LIST OF ATTACHMENTS

None

Paul Suffern  
NTSB, AS-30