



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 10, 2021

Specialist's Factual Report

METEOROLOGY

ERA21LA191

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A. ACCIDENT

Location: Forkston, Pennsylvania
Date: April 22, 2021
Time: 2104 eastern daylight time
0104 Coordinated Universal Time (UTC) on April 23
Airplane: Robinson Helicopter R44; Registration: N4055N

B. METEOROLOGIST

Paul Suffern
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Meteorologist did not travel for this investigation and gathered the weather data for this investigation from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources and also from the National Centers for Environmental Information (NCEI). This Specialist's Factual Report contains the meteorological factors pertinent to the weather surrounding the accident time. All times are eastern daylight time (EDT) and are based upon the 24-hour clock, where local time is - 4 hours from UTC. Directions are referenced to true north and distances are in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports.

The accident site was located at latitude 41.48899° N, Longitude 76.18394° W, with an approximate elevation of 2,150 feet (ft).

D. 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 and the Weather Prediction Center, 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 00-45H.¹

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over the eastern United States for 2000 EDT is provided as figure 1 with the location of the accident site within the red circle. The chart depicted a trough² located from northcentral Pennsylvania to southwestern Pennsylvania. There were no low- or high-pressure systems located near the accident site. The accident site was located east of the surface trough. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present.

The station models around the accident site depicted air temperatures in the mid 30’s to mid 40’s degrees Fahrenheit (°F), dew point temperatures in the teens to upper 20’s °F with temperature-dew point spreads of 2°F or more, a west to northwest wind at 10 knots, mostly cloudy skies, and light snow reported in southcentral New York.

¹

https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235

² Trough – An elongated area of relatively low atmospheric pressure or heights.

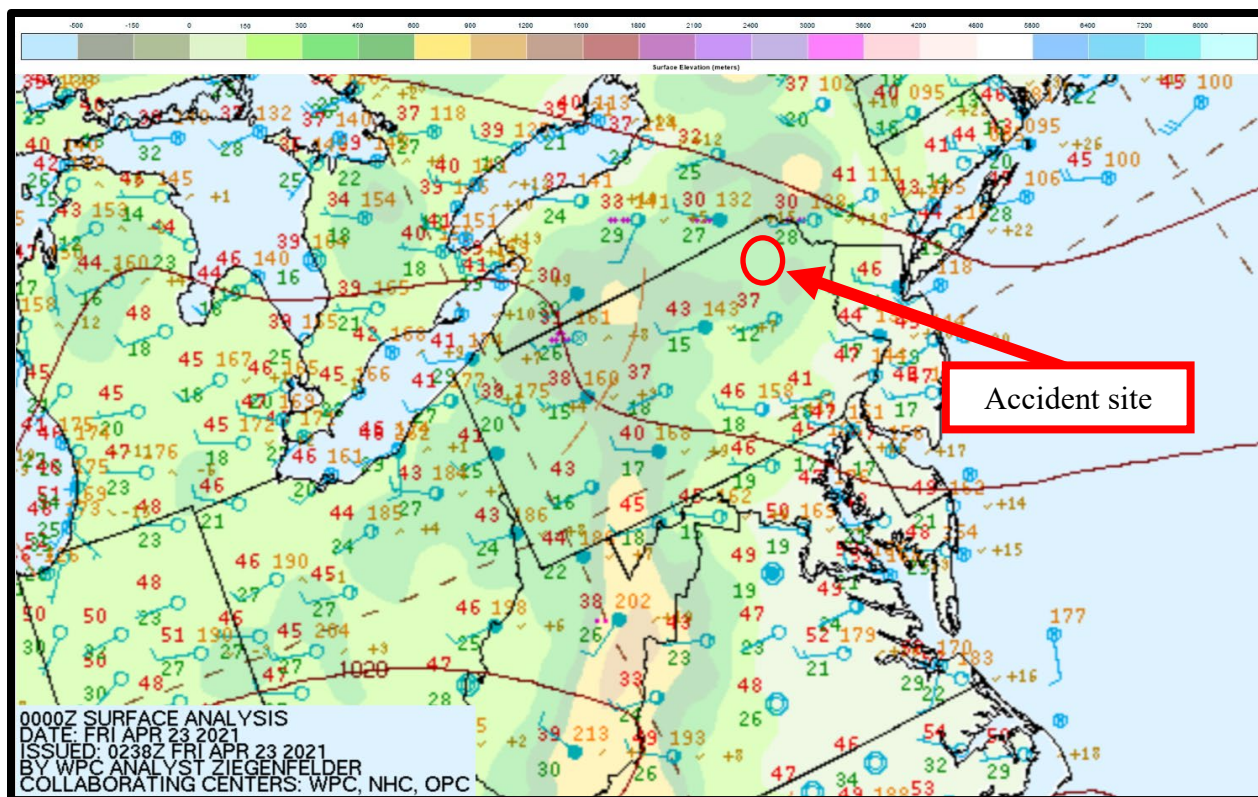


Figure 1 – NWS Surface Analysis Chart for 2000 EDT.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 2000 EDT at 925-, 850- and 700- hectopascals (hPa) are presented in figures 2 through 4. The accident site was located in between two low-level troughs at 925-hPa (figure 2) with the 700-hPa mid-level trough east of the accident located over the western north Atlantic Ocean. There was a west wind between 20 to 30 knots at 925-hPa with the wind remaining westerly at 35 knots by 700-hPa.

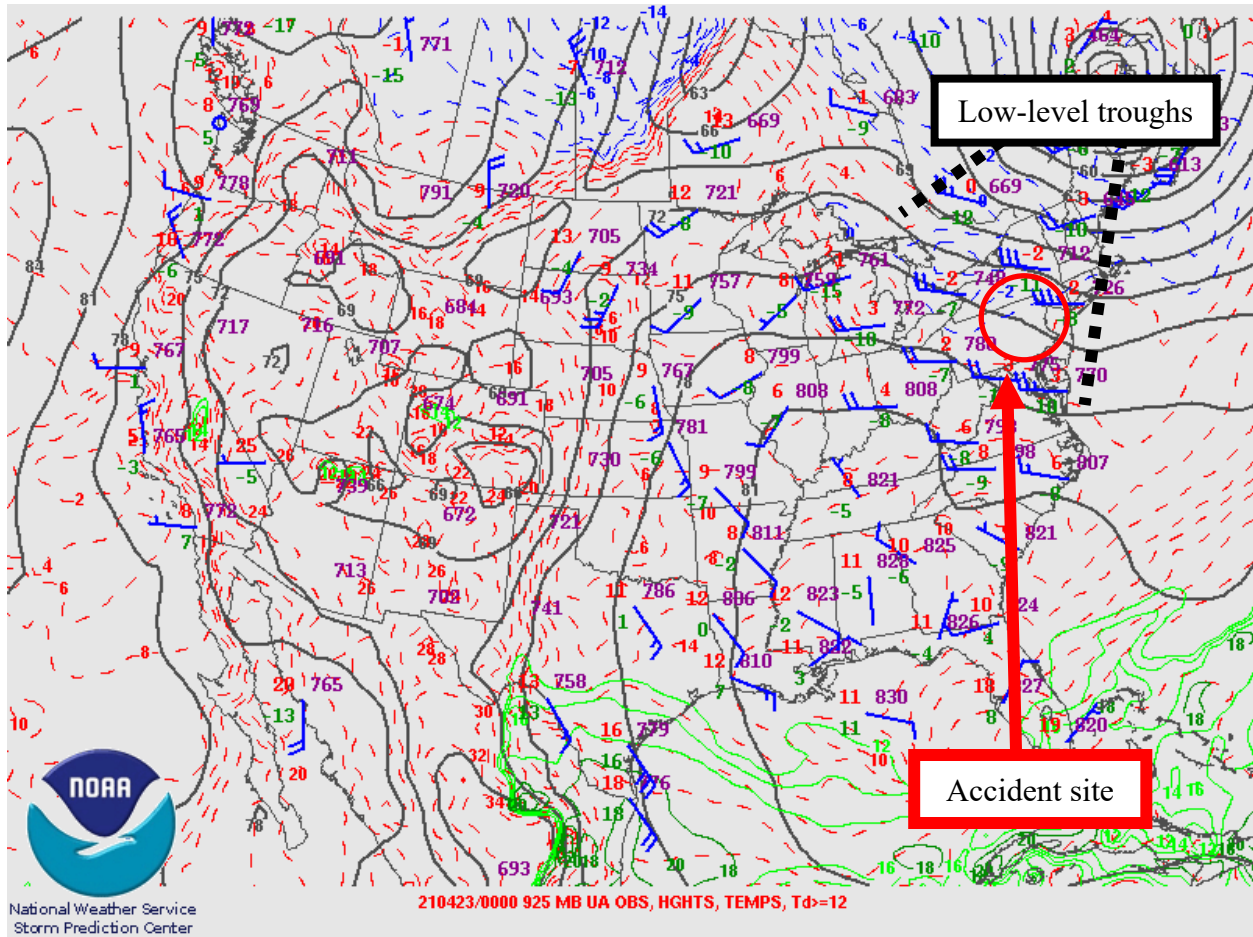


Figure 2 – 925-hPa Constant Pressure Chart for 2000 EDT.

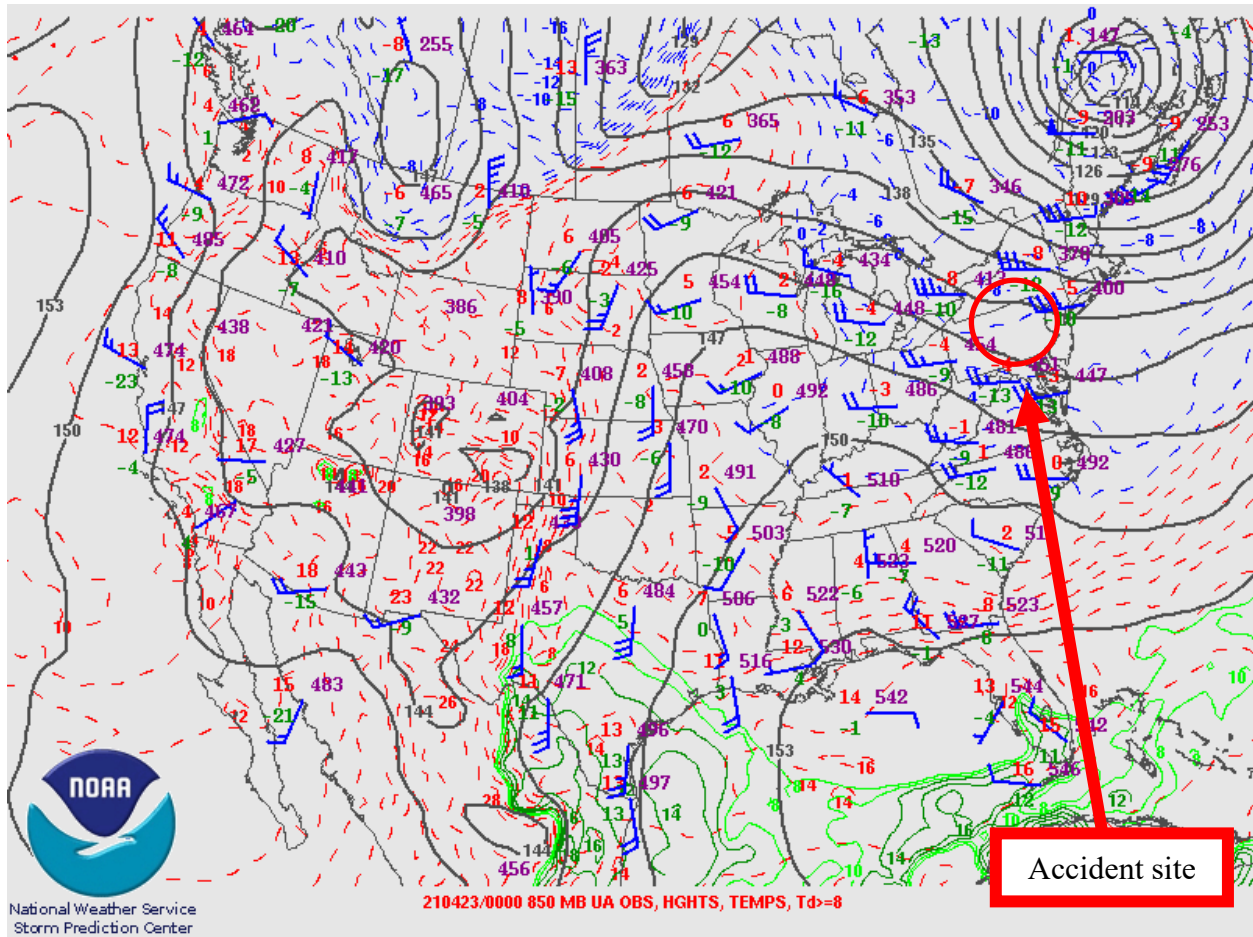


Figure 3 – 850-hPa Constant Pressure Chart for 2000 EDT.

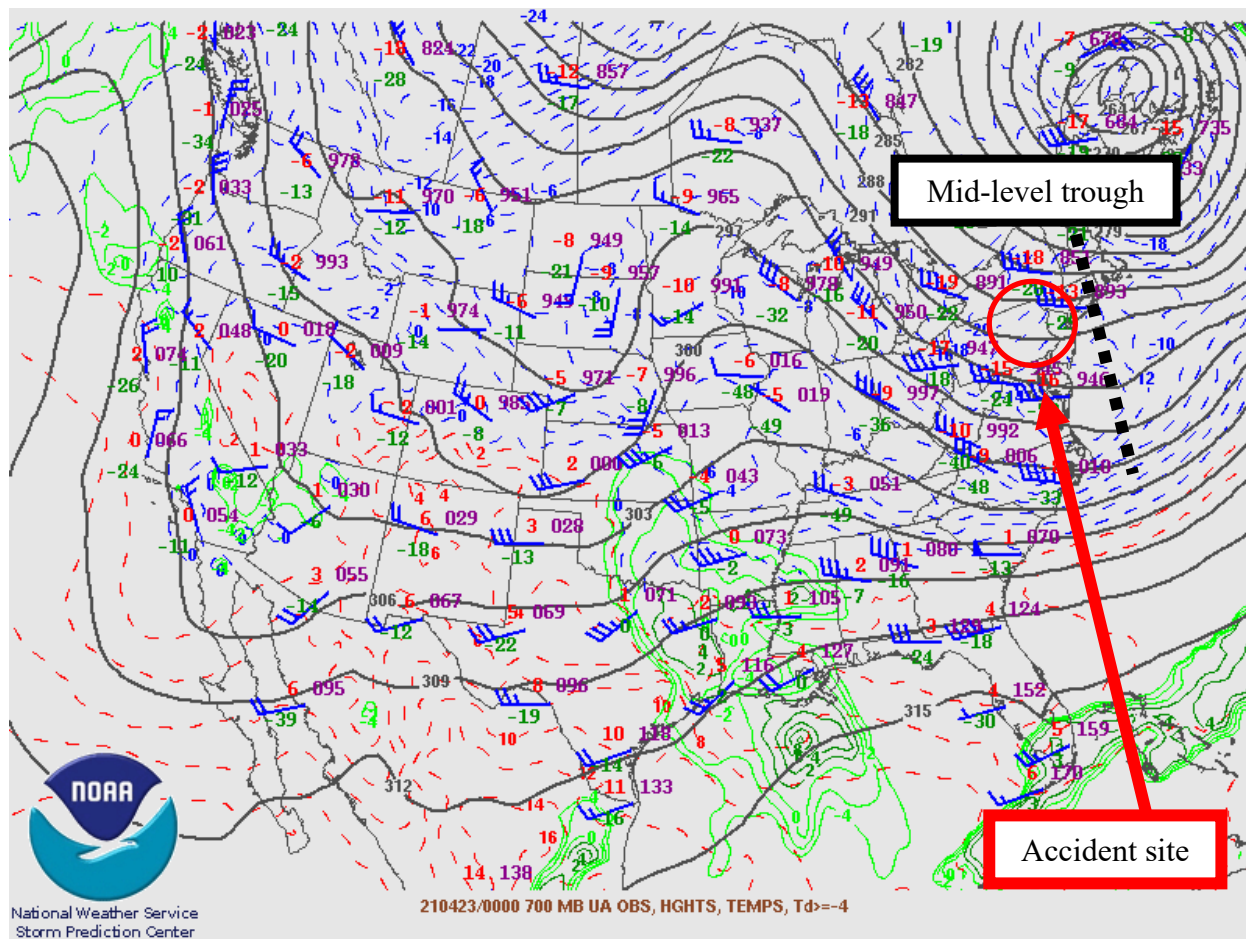


Figure 4 – 700-hPa Constant Pressure Chart for 2000 EDT.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 5 is a local sectional chart with the accident site and the closest weather reporting locations marked.

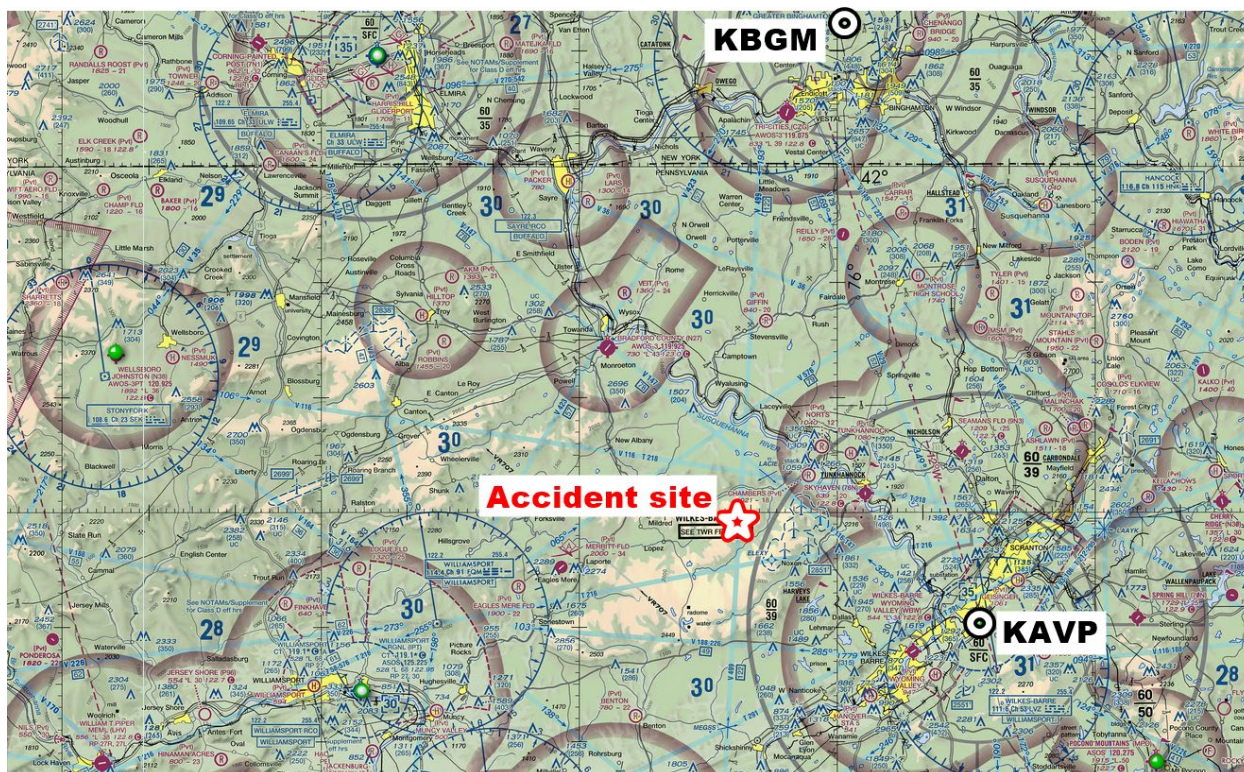


Figure 5 – Sectional map of the accident area with the location of the accident site and surface observation sites.

Wilkes-Barre/Scranton International Airport (KAVP) had the closest official weather station to the accident site. KAVP had an Automated Surface Observing System (ASOS³) whose longline⁴ reports were augmented by air traffic control when the tower was in operation⁵. The KAVP ASOS was located 23 miles southeast of the accident site, at an elevation of 962 ft, and had a 12° westerly magnetic variation⁶ (figure 5). The following automated longline observations were disseminated during the times surrounding the accident:⁷

[1654 EDT] METAR KAVP 222054Z 31010G26KT 10SM BKN060 OVC080 06/M08 A2987
RMK AO2 PK WND 28029/2039 SLP119 60000 T00611083 53001=

³ ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, weather phenomena, ceiling, temperature, dewpoint, altimeter, and barometric pressure.

⁴ “Longline” refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station’s Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline-dissemination of weather observations is the primary vehicle through which the general global public has access to surface weather observations, particularly outside of the aviation community.

⁵ ATC hours of operation unknown.

⁶ Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

⁷ The bold sections in this NWS product and the rest of the products in this report are intended to highlight the text that directly reference the weather conditions that affected the accident location around the accident time. The local times in this section next to the METARs are provided for quick reference between UTC and local times around the accident time.

[1754 EDT] METAR KAVP 222154Z 30015G26KT 10SM OVC080 06/M09 A2988 RMK AO2 PK WND 31029/2140 SLP124 T00561094=

[1854 EDT] METAR KAVP 222254Z 29010KT 10SM SCT075 05/M09 A2989 RMK AO2 SLP127 T00501089=

[1954 EDT] METAR KAVP 222354Z 29008KT 10SM FEW070 FEW080 04/M09 A2991 RMK AO2 PK WND 32027/2305 RAB08E17 SLP134 P0000 60000 T00441089 10072 20039 53014=

[2054 EDT] METAR KAVP 230054Z 29014G20KT 10SM OVC075 04/M08 A2993 RMK AO2 SLP139 T00441078=

ACCIDENT TIME 2104 EDT

[2154 EDT] METAR KAVP 230154Z 30008KT 10SM FEW050 BKN065 OVC085 04/M07 A2994 RMK AO2 SLP143 T00441067=

[2254 EDT] METAR KAVP 230254Z 33011KT 9SM BKN044 OVC065 03/M04 A2996 RMK AO2 PK WND 28027/0223 RAB18E41SNB41E51 SLP151 P0000 60000 T00281039 53016=

KAVP weather at 2054 EDT, wind from 290° at 14 knots with gusts to 20 knots, visibility 10 miles or greater, overcast ceiling 7,500 ft above ground level (agl), temperature of 4° Celsius (C), dew point temperature of -8°C, and an altimeter setting of 29.93 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, sea level pressure 1013.9 hPa, temperature of 4.4°C, dew point temperature of -7.8°C.

KAVP weather at 2154 EDT, wind from 300° at 8 knots, visibility 10 miles or greater, few clouds at 5,000 ft agl, broken ceiling 6,500 ft agl, overcast skies 8,500 ft agl, temperature of 4°C, dew point temperature of -7°C, and an altimeter setting of 29.94 inHg. Remarks: automated station with a precipitation discriminator, sea level pressure 1014.3 hPa, temperature of 4.4°C, dew point temperature of -6.7°C.

Greater Binghamton Airport (BGM) had an ASOS whose longline reports were augmented by air traffic control when the tower was in operation⁸. The BGM ASOS was located 44 miles north of the accident site at an elevation of 1,636 ft. The following automated longline observations were disseminated during the times surrounding the accident:

[1944 EDT] SPECI KBGM 222344Z 32009G16KT 1SM -SN OVC027 M01/M04 A2986 RMK AO2 SFC VIS 4 SNE03B22 P0000 T10061039=

⁸ ATC hours of operation between 6am and midnight local.

[1953 EDT] METAR KBGM 222353Z 31009KT 3/4SM -SN BR FEW014 BKN021 OVC031
M01/M03 A2986 RMK AO2 TWR VIS 1 SNE03B22 SLP132 P0000 60001
T10111028 10022 21011 51015 RVRNO=

[1958 EDT] SPECI KBGM 222358Z 31009KT 3/4SM -SN BR FEW014 OVC025 M01/M03
A2986 RMK AO2 TWR VIS 1 1/2 P0000 T10111028 RVRNO=

[2003 EDT] SPECI KBGM 230003Z 32007KT 1 1/2SM -SN BR OVC030 M01/M03 A2986
RMK AO2 SFC VIS 2 1/2 P0000 T10111028=

***[2053 EDT] METAR KBGM 230053Z 31005KT 1 1/2SM -SN BKN043 OVC055 M01/M03
A2988 RMK AO2 SFC VIS 10 SNE09B49 SLP135 P0000 T10111028=***

ACCIDENT TIME 2104 EDT

***[2121 EDT] SPECI KBGM 230121Z 30008KT 1 1/2SM -SN BR BKN029 BKN038 OVC050
M01/M02 A2989 RMK AO2 SFC VIS 4 P0001 T10111022=***

[2133 EDT] SPECI KBGM 230133Z 30009KT 9SM SCT031 BKN049 OVC060 M01/M03
A2988 RMK AO2 SNE29 P0001 T10111028=

BGM weather at 2053 EDT, wind from 310° at 5 knots, visibility 1 and a half miles, light snow, broken ceiling 4,300 ft agl, overcast skies 5,500 ft agl, temperature of -1°C, dew point temperature of -3°C, and an altimeter setting of 29.88 inHg. Remarks: automated station with a precipitation discriminator, surface visibility 10 miles, snow ended at 2009 EDT and began at 2049 EDT, sea level pressure 1013.5 hPa, a trace of precipitation since 1953 EDT, temperature of -1.1°C, dew point temperature of -2.8°C.

BGM weather at 2121 EDT, wind from 300° at 8 knots, visibility 1 and a half miles, light snow, mist, broken ceiling 2,900 ft agl, broken skies at 3,800 ft agl, overcast skies 5,000 ft agl, temperature of -1°C, dew point temperature of -2°C, and an altimeter setting of 29.89 inHg. Remarks: automated station with a precipitation discriminator, surface visibility 4 miles, 0.01 inches of precipitation since 2053 EDT, temperature of -1.1°C, dew point temperature of -2.2°C.

The observations from KAVP surrounding the accident time indicated VFR⁹ conditions with IFR conditions reported at BGM in light snow.

⁹ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

3.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)¹⁰ model sounding was created for the accident site for 2100 EDT which provided a surface elevation of 1,959 ft.¹¹ The 2100 EDT HRRR sounding was plotted on a standard Skew-T Log P diagram¹² with the derived stability parameters included in figure 6 with data from the surface to 600-hPa (or approximately 14,000 ft msl). These data were analyzed using the RAOB¹³ software package. The sounding depicted the lifted condensation level (LCL)¹⁴ at 2,849 ft agl (4,808 ft msl) and the convective condensation level (CCL)¹⁵ at 4,118 ft agl (6,077 ft msl). The freezing level was located near the surface. The precipitable water value was 0.22 inches.

¹⁰ The HRRR is a NOAA real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one hour period.

¹¹ HRRR sounding was created using NOAA Air Resource Laboratory: <https://ready.arl.noaa.gov/READYamet.php>

¹² 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.

¹³ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Eosonde Research Services, The Villages, Florida.

¹⁴ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁵ 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.

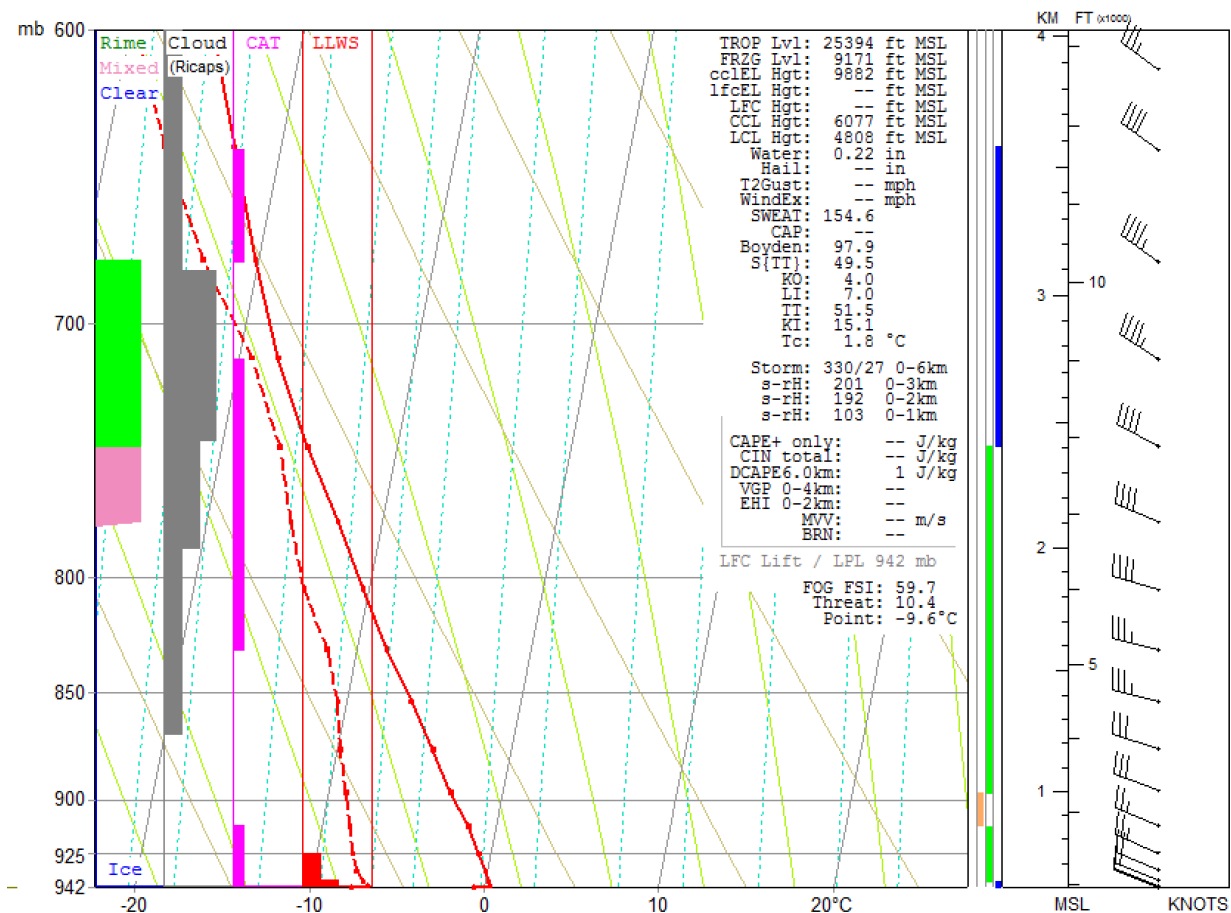


Figure 6 – 2100 EDT HRRR sounding.

The 2100 EDT HRRR sounding for the accident site indicated a conditionally unstable environment from the surface through 8,000 ft msl. Clouds were indicated by RAOB from 4,000 ft msl (~2,000 ft agl) through 14,000 ft msl. RAOB indicated moderate rime or mixed icing from 7,000 ft to 10,000 ft msl.

The 2100 EDT HRRR sounding wind profile indicated a near surface wind from 294° at 10 knots with the wind remaining out of the west to northwest through 14,000 ft msl. The wind speed increased to 30 knots by 3,500 ft msl with the wind speed to 45 knots by 10,000 ft msl. RAOB indicated the possibility of light to moderate low-level wind shear (LLWS) between the surface and 1,000 ft agl. RAOB indicated the possibility of light clear-air turbulence in several layers between the surface and 11,500 ft msl.

4.0 Satellite Data

The Geostationary Operational Environmental Satellite number 16 (GOES-16) visible and infrared data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System software. Visible and infrared imagery (GOES-16 bands 2 and 13) at wavelengths of 0.64 microns (μm) and 10.3 μm , respectively, were retrieved for the period from 1800 EDT through 2300 EDT and reviewed, and the closest images to the time of the accident were documented. Due to sun angle the visible imagery did not provide helpful data.

Figure 7 presents the GOES-16 infrared imagery from 2100 EDT at 6X magnification with the accident site highlighted with a red square. The lower brightness temperatures (yellow colors; higher cloud tops) were located above and to the north of the accident site. The brightness temperature of about 255 Kelvin above the accident site would have been near 9,000 ft msl based on the vertical temperature profile provided by the 2100 EDT HRRR sounding. It should be noted these figures have not been corrected for any parallax error.

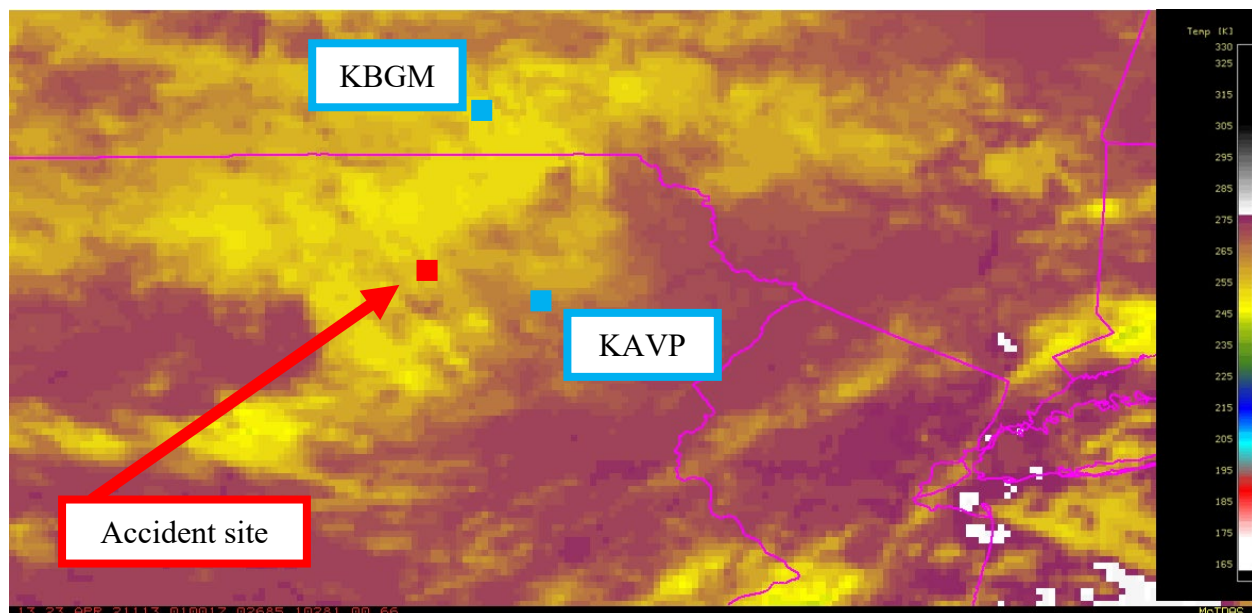


Figure 7 – GOES-16 infrared image at 2100 EDT.

5.0 Regional Radar Imagery Information

A regional view of the NWS national composite radar mosaic is included as figure 8 for 2105 EDT with the approximate location of the accident site marked within a red circle. The image depicted echoes from 15 to 30 decibels (dBZ¹⁶) above the accident site at 2105 EDT.

¹⁶ 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.

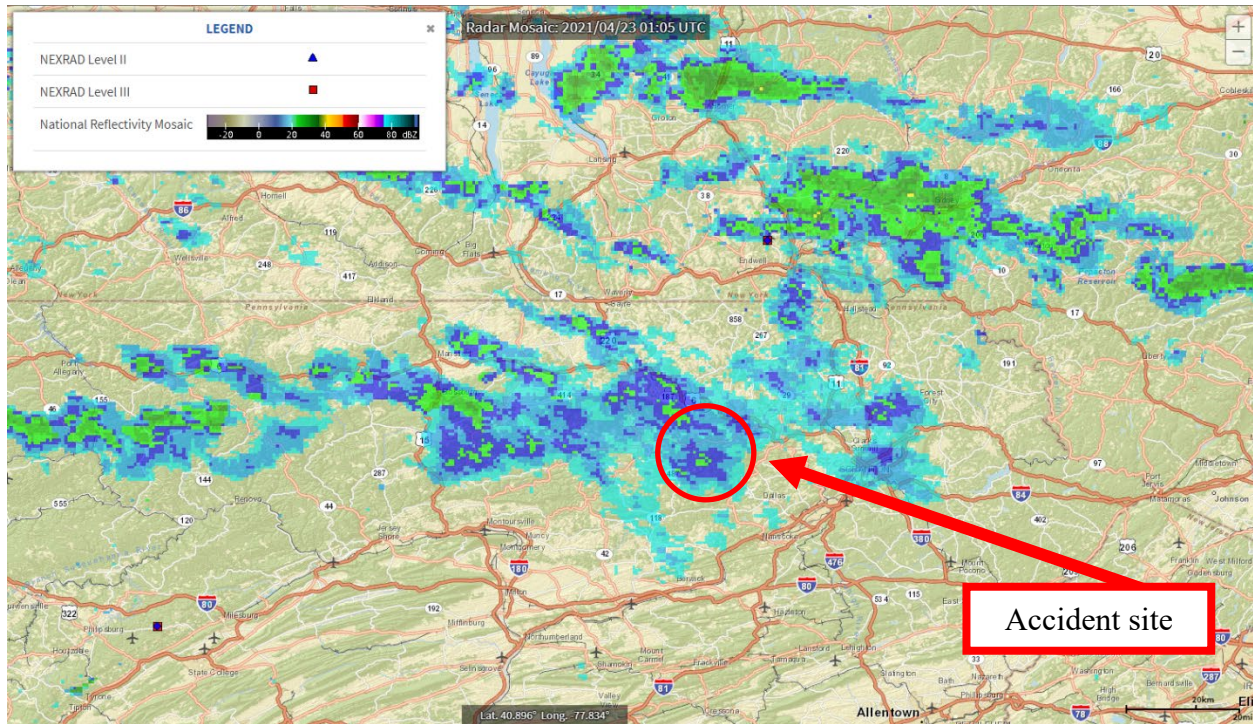


Figure 8 – Regional Composite Reflectivity image for 2105 EDT.

6.0 Radar Imagery Information

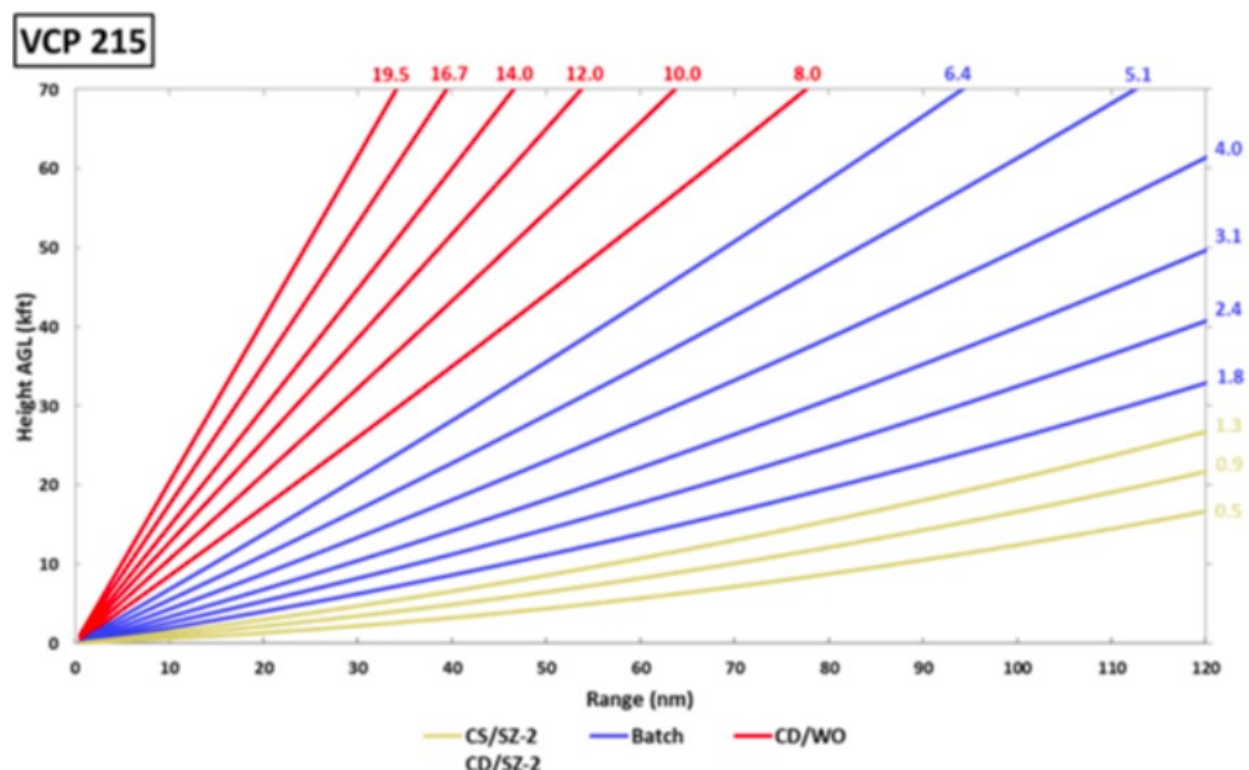
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)¹⁷ to the accident site was Binghamton, New York, (KBGM WSR-88D) located 44 miles north of the accident (figure 5). Level II archive radar data were obtained from the NCEI utilizing the NEXRAD Data Inventory Search and displayed using the NOAA’s Weather and Climate Toolkit software.

6.1 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. Products that require data from multiple elevation scans are not available until the end of the five-to-ten-minute volume scan.

¹⁷ 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. The radar produces three basic types of products: base reflectivity, base radial velocity, and base spectral width.

The WSR-88D operates in two main scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has three common scanning strategies¹⁸. The most common is where the radar makes 15 elevation scans from 0.5° to 19.5° every six minutes. This scanning strategy is documented as volume coverage pattern 215 (VCP-215). Mode B is the clear-air mode, where the radar makes 9 elevation scans during a ten-minute period. During the period surrounding the accident, the KBGM WSR-88D radar was operating in the precipitation mode VCP-215. 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-215 Precipitation Mode Scan Strategy.

¹⁸ Contiguous Surveillance (CS)--The low Pulse Repetition Frequency (PRF) scan of the split cut. Gives a high $R_{\max}$ value to determine proper target location and intensity, but a low $V_{\max}$ value limits the velocities that can be measured. Contiguous Doppler (CD)--The high PRF scan of the split cut. Gives a low $R_{\max}$ value causing more range folded (multiple trip) echoes, but a high $V_{\max}$ value to get higher, more accurate velocity values.

Batch Mode – Uses alternating low and high PRFs on each radial for one full rotation at each elevation angle. The two resulting data sets (low PRF and high PRF) are combined to resolve range ambiguity. Used in the middle elevation angles.

W – With range unfolding (W)

WO – Without range unfolding (WO)

6.2 Beam Height Calculation

Assuming standard refraction¹⁹ of the KBGM WSR-88D radar beam with the antenna elevation at 1,703 ft, and considering a beamwidth²⁰ of 0.95°, the following table shows the approximate heights for the radar beam center, base, and top for an antenna elevation over the accident site. These heights have been rounded to the nearest 10 ft.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP
KBGM WSR-88D 0.5°	5,430 ft	3,260 ft	7,600 ft

Based on the radar height calculations, the elevation scan from KBGM WSR-88D listed in the above table depicted the conditions between 3,260 ft and 7,600 ft above msl over the accident site and these scans “saw” the closest altitudes to the surface.

6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors²¹ 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 dBZ and is a general measure of echo intensity. FAA Advisory Circular AC 00-24C²², “Thunderstorms,” dated February 19, 2013, also defines the echo intensity levels and weather radar echo intensity terminology associated with those levels. For dBZ values less than 30 the weather radar echo intensity terminology should be “light.” For dBZ values between 30 and 40, the terminology should be “moderate.” “Heavy” terminology is used for dBZ values greater than 40 dBZ but less than 50 dBZ, inclusive. Finally, any dBZ values above 50 dBZ shall be described as “extreme.”

¹⁹ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

²⁰ Beamwidth - the angular separation between the half power points on the antenna radiation pattern, where the gain is one half the maximum value.

²¹ 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.

²²

https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1020774

6.4 Base Reflectivity and Lightning Data

Figures 9 and 10 present the KBGM WSR-88D base reflectivity images for the 0.5° elevation scans initiated at 2058:55 and 2104:07 EDT, respectively, with resolutions of 0.5° X 250 m. Reflectivity values between 10 and 25 dBZ were located above the accident site at the accident time. The precipitation was moving from northwest to southeast over the accident site at the accident time (attachment 1).

There were no lightning flashes²³ near the accident site at the accident time.²⁴

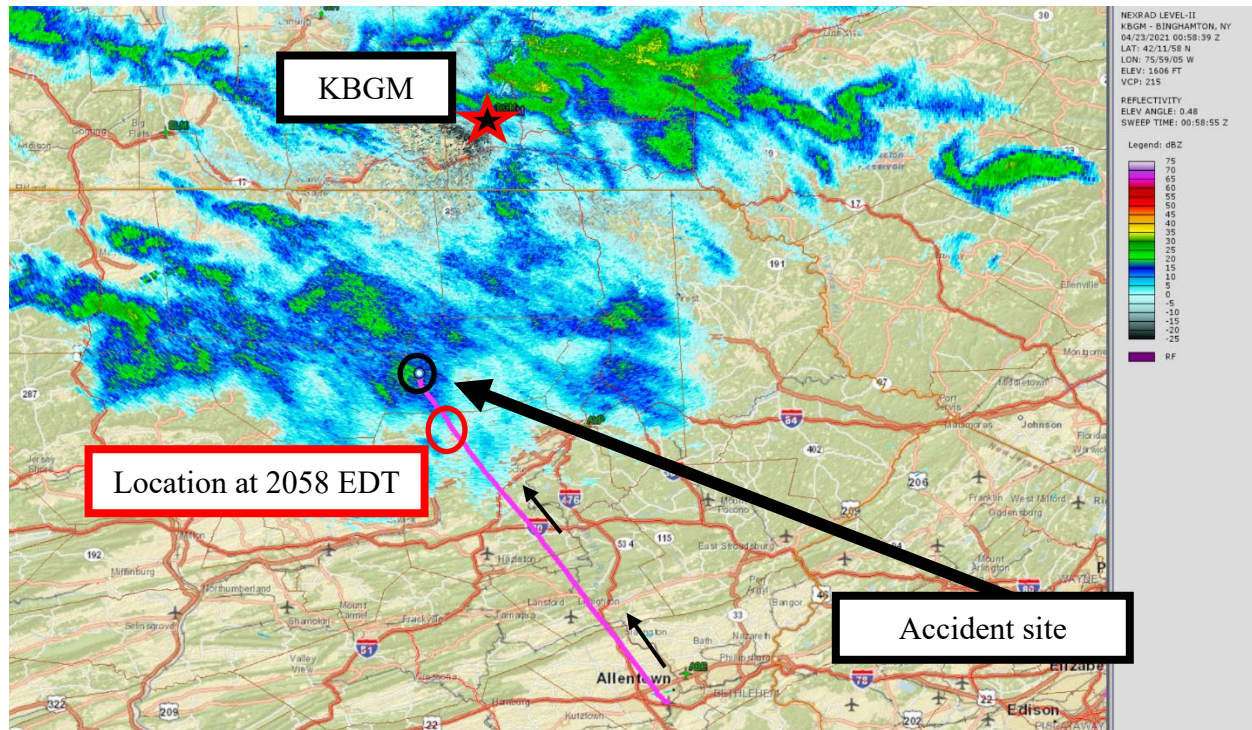


Figure 9 – KBGM WSR-88D reflectivity for the 0.5° elevation scan initiated at 2058:55 EDT with the accident site marked with a black circle and the accident flight track in pink with arrows pointing in the direction of travel.

²³ Lightning Flash – This is one contiguous conducting channel and all the current strokes/pulses that flow through it. There are two types of flashes: ground flashes and cloud flashes.

²⁴ A review of Earth Networks Total Lightning network was done.

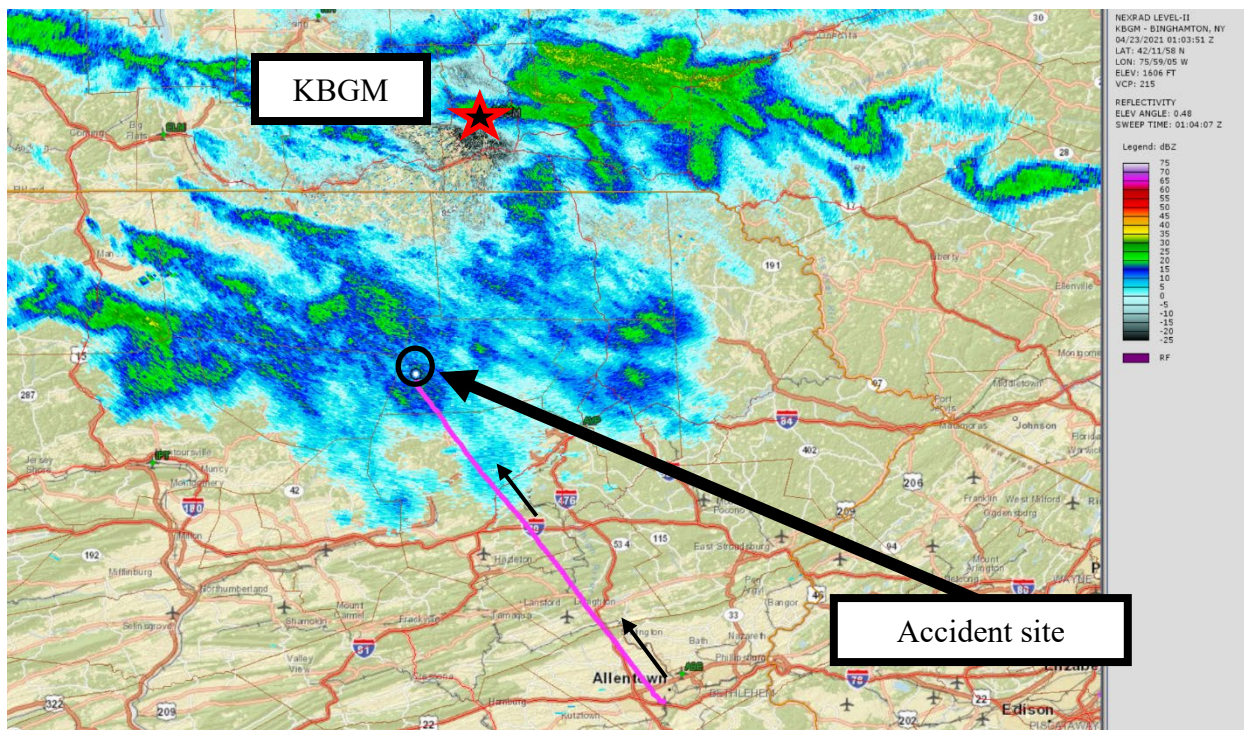


Figure 10 – KBGM WSR-88D reflectivity for the 0.5° elevation scan initiated at 2104:07 EDT with the accident site marked with a black circle and the accident flight track in pink with arrows pointing in the direction of travel.

7.0 Pilot Reports

The longline-disseminated pilot reports²⁵ (PIREPs) distributed into the national airspace (NAS) were reviewed from about three hours prior to the accident time to two hours after the accident time and the only PIREP within 100 miles of the accident site below 18,000 ft msl is shown below:

ELM UA /OV ULW045010/TM 0149/FL090/TP PC12/TA M15/IC LGT RIME

8.0 Significant Meteorological Information

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories valid for the accident site at the accident time.

9.0 Center Weather Service Advisories

The New York (ZNY) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. There were no Center Weather Advisories (CWA) valid at the accident time.

²⁵ Only pilot reports with the World Meteorological Organization headers UBPA**, UBNY**, and UBNJ** were considered. These do not include pilot reports only broadcast via radio.

10.0 Airmen's Meteorological Information

Airmen's Meteorological Information (AIRMET) advisories Sierra, Tango, and Zulu were valid for the accident site at the accident time (issued around 1645 EDT). The AIRMETs warned of moderate turbulence below 12,000 ft msl, mountain obscuration conditions due to clouds and precipitation, and moderate icing between the freezing level²⁶ and 14,000 ft msl:

WAUS41 KPCI 222045

WA1S

-BOSS WA 222045

AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 230300

AIRMET IFR...ME NH VT

FROM 70NW PQI TO 60NE PQI TO 30E HUL TO 40SE MPV TO 20WSW YSC TO 70NW PQI

CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS ENDG 00-03Z.

AIRMET MTN OBSCN...ME NH VT MA NY PA

FROM 70NW PQI TO 20SW MLT TO CON TO 30SE ALB TO 20N SAX TO HAR TO 50WSW HNK TO JHW TO 20NNE SYR TO 20SW MSS TO YSC TO 70NW PQI MTNS OBSC BY CLDS/PCPN. CONDS CONTG BYD 21Z ENDG 21-00Z.

AIRMET MTN OBSCN...PA WV MD VA

FROM 40SSE EWC TO 50SE JST TO 50N LYH TO 30ENE BKW TO HNN TO AIR TO 40SSE EWC

MTNS OBSC BY CLDS/PCPN. CONDS CONTG BYD 21Z ENDG 21-00Z.

....

WAUS41 KPCI 222045

WA1T

-BOST WA 222045

AIRMET TANGO UPDT 7 FOR TURB STG WNDZ AND LLWS VALID UNTIL 230300

AIRMET TURB...ME NH MA RI NY NJ OH WV MD DC DE VA NC SC AND CSTL WTRS

FROM 110SSW YSJ TO 200SE ACK TO 160SE SIE TO 190ESE ECG TO 140SE ILM TO 20SSW CLT TO 30NNE ODF TO 30SSW VXV TO HNV TO HNN TO CVG TO FWA TO 40ENE HNN TO 60SSE JFK TO 110SSW YSJ

MOD TURB BTN FL180 AND FL350. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET TURB...VA NC SC GA AND CSTL WTRS

FROM 30ESE ORF TO 80SE ECG TO 30E CHS TO 20NW MCN TO LGC TO GQO TO HNV TO 30ESE ORF

MOD TURB BLW 120. CONDS CONTG BYD 03Z ENDG 03-06Z.

AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS

FROM 70NW PQI TO 50NNE PQI TO 50WSW YSJ TO 200SE ACK TO 160SE SIE TO 30ESE ORF TO HNV TO 40ESE LOZ TO 40SW EKN TO 30E CLE TO 20E YYZ TO 50NW SYR TO 20SE YOW TO YSC TO 70NW PQI MOD TURB BLW 120. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET STG SFC WNDZ...ME NH MA RI AND CSTL WTRS

²⁶ Freezing level between the surface and 3,000 ft msl.

FROM 50WSW YSJ TO 200SE ACK TO 200S ACK TO 90SSW ACK TO 20ESE
ACK TO 40ESE BOS TO 40E ENE TO 50WSW YSJ
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 03Z
THRU 09Z.

.
LLWS POTENTIAL...ME NH VT NY
BOUNDED BY 70NW PQI-40ENE PQI-20ENE HUL-20NNE CON-60S MSS-20SE
YOW-20S YSC-70NW PQI
LLWS EXP. CONDS DVLPG 21-00Z. CONDS CONTG BYD 03Z THRU 09Z.

.
OTLK VALID 0300-0900Z...TURB MA RI NY NJ PA OH LE WV MD DC DE VA
NC SC AND CSTL WTRS
BOUNDED BY 140ENE ACK-200SE ACK-160SE SIE-190ESE ECG-150ESE ILM-
20NNW FLO-50WSW HMV-HMV-HNN-CVG-FWA-50SW DXO-40SSE AIR-120SE SIE-
140ENE ACK
MOD TURB BTN FL180 AND FL350. CONDS CONTG THRU 09Z.

....

WAUS41 KPCI 222045
WA1Z
-BOSZ WA 222045
AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 230300

.
**AIRMET ICE...ME NH VT MA RI CT NY LO NJ PA LE AND CSTL WTRS
FROM 70NW PQI TO 30NNE PQI TO 50SE HUL TO 200SE ACK TO 210S ACK
TO 30SSE JFK TO 40S SAX TO 20SE HAR TO 40WSW ERI TO 20SE YYZ TO
20NW SYR TO 30SE YOW TO YSC TO 70NW PQI
MOD ICE BTN FRZLVL AND 140. FRZLVL SFC-030. CONDS CONTG BYD 03Z
THRU 09Z.**

.
AIRMET ICE...PA OH WV MD VA
FROM 30SSW EWC TO 60SSE JST TO 30S PSK TO 30WSW HMV TO 20SE HNN
TO 60E CVG TO 30SSW EWC
MOD ICE BTN 050 AND 100. CONDS ENDG 21-00Z.

.
FRZLVL...RANGING FROM SFC-050 ACRS AREA
SFC ALG 70W YSC-20NNW MPV-50SE HUL
040 ALG 40W BKW-RIC-20S ORF

....

11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products issued before the accident flight and valid at 2000 EDT are shown in attachment 2. The GFA surface forecast products indicated VFR surface visibilities with a chance (between 30 to 60 percent) of snow showers and a surface wind from the northwest at 10 knots and gusts to 15 knots. The GFA cloud forecast valid before departure for around the accident time indicated broken to overcast ceilings between 2,300 and 7,000 ft msl with cloud tops at FL220²⁷. The Graphical AIRMET²⁸ (G-AIRMET) Sierra and Zulu for mountain obscuration and icing valid for the accident site were overlaid on the GFA cloud forecast graphics. The only human-generated information reflected in the two GFA products are the G-AIRMETs and the GFA is “human-over-the-loop.” For more information please see attachment 2.

12.0 Terminal Aerodrome Forecast

KAVP was the closest airport to the accident site with an NWS²⁹ Terminal Aerodrome Forecast (TAF). The KAVP TAF valid at the time of the accident was issued at 1926 EDT and was valid for a 24-hour period beginning at 2000 EDT. The 1926 EDT TAF for KAVP was as follows:

TAF KAVP 222326Z 2300/2324 **29010KT P6SM BKN060**
TEMPO 2302/2305 29012G25KT BKN030
FM231500 28011G19KT P6SM SKC=

For the accident time the forecast expected a wind from 290° at 10 knots, greater than 6 miles visibility, and a broken ceiling at 6,000 ft agl.

13.0 NWS Area Forecast Discussion

The NWS office in Binghamton, New York, (WFO BGM) issued an Area Forecast Discussion (AFD) at 1953 EDT. The aviation section of the AFD discussed lake effect snow showers moving across the region:

FXUS61 KBGM 222353
AFDBGM

Area Forecast Discussion
National Weather Service Binghamton NY
753 PM EDT Thu Apr 22 2021

.SYNOPSIS...

High pressure starts building into the region this evening,
with snow showers coming to an end. Friday will be dry and

²⁷ Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of ft. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 inHg), the standard sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.

²⁸ <https://aviationweather.gov/gairmet>

²⁹ According to NWS Instruction 10-813: “A NWS TAF consists of the expected meteorological conditions significant to aviation at an airport for a specified time period. For the U.S., this is the area within five (5) statute miles (SM) of the center of an airport's runway complex.” www.nws.noaa.gov/directives/sym/pd01008013curr.pdf

seasonably mild, but another storm system will bring a chance for rain Saturday night into Sunday. High pressure makes a return Monday, with dry air and above average temperatures expected into Wednesday.

&&

.NEAR TERM /THROUGH FRIDAY NIGHT/...

750 PM Update...

Made some minor tweaks to PoPs and went with coverage qualifiers through midnight.

Snow showers have morphed into larger cells ahead of an incoming shortwave trough, with locally heavy bursts of snow and lower visibilities noted on area webcams, aided by wind gusts of 25 to 30 mph. With the sun setting, melting will be slower, allowing some thin slushy patches to develop on roads, making conditions a bit more slick. As temperatures drop below freezing, some icy spots could develop, especially on bridges and overpasses.

Overall still expect snow shower coverage to decrease sharply between 9 PM and Midnight, especially behind the shortwave trough.

245 PM Update...

Lake effect snow showers continue across the region this afternoon. The snow showers should persist into this evening as another weak short wave drops across west-central NY. However, at the same time, H850 ridging is starting to build into the area from the southwest and this will help dry things out early this evening. Expecting clouds to become mostly clear overnight, but there remains a decent pressure gradient over the area, which will help keep temperatures from really plummeting overnight. Even so, overnight lows will still drop back into the upper 20s and lower 30s.

High pressure/ridging continues to build in from the west tomorrow and much warmer conditions are expected with plenty of sunshine Friday afternoon. Temperatures on Friday will climb into the mid 50s to lower 60s. Winds will still remain quite gusty, as forecast soundings show pretty good mixing up to 5K+ feet, so gusts may exceed 25 mph at times through Friday afternoon. Decided to add a fire weather discussion to the AFD below, as conditions may elevate fire danger in some areas. The pressure gradient eases tomorrow night and winds should become mostly calm in the valleys by Saturday morning. Expect another chilly night, with temperatures dropping into the 30s across much of the area.

&&

.SHORT TERM /SATURDAY THROUGH SUNDAY NIGHT/...

330 pm update...

Saturday will be dry with highs in the 60s and increasing clouds. The trend has been to slow down the next system. Rain moves in late Saturday evening and continues into Sunday morning. Strengthening surface low pressure moves northeast out of the Gulf to the east coast and NYC Sunday morning. The speed is fast with an upper level trough moving right behind it. The upper level trough cuts off in New England slowing the low well after it exits our area. Rainfall will range from around a quarter inch in the central southern tier to around half an inch in the northern Poconos. This amount of rain will only cause small rises on the streams and rivers with green up on the way.

Sunday the rain exits from west to east during the morning to early afternoon. Skies become mostly sunny in the afternoon. High temperatures will be mostly in the mid and upper 50s, but some low 60s are likely in the Wyoming Valley.

Sunday night cold air advection from the northwest will continue sending temperatures into the 30s.

&&

.LONG TERM /MONDAY THROUGH THURSDAY/...
330 pm update...

Little change. continue to go above guidance for the high temperatures Tuesday to Thursday. Wednesday and Thursday could be around 80 degrees.

High pressure is over the area Monday evening then a deep southwest flow bringing much above average temperatures into the area mid week. For the end of the week model differences on when a cold front sinks southeast into the area.

previous discussion...

Gradual clearing Sunday afternoon and night as the low pressure system departs and high pressure builds into the area by Monday. This high pressure looks to become firmly established with a strong mid level ridge in place as well into the middle of next week. given the strength of the mid-level ridge opted for a slower timing of the next cold front holding off till after Wednesday.

Also, warm air advection on the backside of the high should result in a gradual warming trend with highs getting into the 60's and 70's. A few spots Lows will be slower to respond but with dry weather a could push 80 based on modeled boundary layer temperatures on Wednesday. So continued to trend highs toward the warmest ensemble members. Also, a wide diurnal spread is anticipated with 30's and 40's for lows.

Mixing may become more of a concern as we get closer in time to the middle of next week which usually causes for busts of modeled RH values in the afternoon. Given the rain expected Sunday, it would take fuels some time to dry out in terms of any fire spread concerns due to weather.

&&

.AVIATION /00Z FRIDAY THROUGH TUESDAY/...

Lake effect snow showers continue this evening though will be coming to an end around 4z. SYR and RME already had dry air move in with VFR conditions expected over the next 24 hours.

Intermittent snow showers continue at BGM, ITH, and ELM through about 3z and after that VFR conditions with dry air moving in.

The snow showers will lose most of their moisture before they get to AVP but some lower MVFR ceilings are possible for a few hours early this evening. The only concern tomorrow will be gusty west winds with day time heating at all terminals but gusts will largely be below 25 kts.

Outlook...

Friday Night through Saturday... Mainly VFR expected

Saturday night...A system brings rain and deteriorating conditions.

Sunday through Tuesday...Rain begins to gradually move out of the area Sunday morning with VFR conditions returning Sunday afternoon and remaining through the beginning of next week.

&&

.FIRE WEATHER...

A deep, well mixed boundary layer on Friday will allow drier air and gusty winds to mix down from aloft. Min RH values will be between 20 to 30 percent in NE PA and into Sullivan County NY and values will be in the 25 to 35 percent range across Central NY. Winds will be gusty out of the WNW through the day, topping out around 25 mph during the afternoon, before easing up tomorrow evening. Latest observed 10 hour fuels are high...in the 15 to 25 percent range. Although we may hit Red Flag weather conditions in NE PA and Sullivan County NY, recent precipitation and the state of current 1 and 10 hour fuel RH values may likely only warrant an SPS.

Saturday the relative humidity fall below 40 percent but winds will be lighter. South winds at 10 mph possibly gusting to 20 mph in the afternoon.

&&

.BGM WATCHES/WARNINGS/ADVISORIES...

PA...None.

NY...None.

&&

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14.0 Winds and Temperature Aloft Forecast

The NWS 1557 EDT Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

```
FBUS31 KWNO 221957
FD1US1
DATA BASED ON 221800Z
VALID 230000Z    FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT  3000    6000    9000   12000   18000   24000   30000   34000   39000
AVP 2927 2935-10 3043-18 3039-21 2943-33 2945-43 304446 294645 294945
```

The closest forecast point to the accident site was AVP. The 1557 EDT AVP forecast for use between 1600 EDT and 2300 EDT indicated a wind at 3,000 ft from 290° at 27 knots, a wind at 6,000 ft from 290° at 35 knots with a temperature of -10°C, and a wind at 9,000 ft from 300° at 43 knots with a temperature of -18°C.

15.0 Pilot Weather Briefing

The accident pilot did not request weather information³⁰ from Leidos Flight Service.

A search of archived ForeFlight information indicated that the accident pilot did not request weather information from ForeFlight. There is no record of the accident pilot receiving or retrieving any other weather information before or during the accident flight.

16.0 Astronomical Data

The astronomical data obtained for the accident site on April 22, 2021, indicated the following:

SUN	
Begin civil twilight	0545 EDT
Sunrise	0614 EDT
Sun transit	1303 EDT
Sunset	1953 EDT
End civil twilight	2023 EDT
Accident time	2104 EDT³¹

³⁰ https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf

³¹ Inserted accident time for reference and context.

MOON

Moonrise	1433 EDT
Accident time	2104 EDT³²
Moon transit	2143 EDT
Moonset	0410 EDT on April 23

At the time of the accident the Moon was located at an altitude of 60.66° and azimuth of 160.80° with 77.7% of the Moon visible disk illuminated.

E. LIST OF ATTACHMENTS

Attachment 1 – KBGM WSR-88D base reflectivity animation from 2036 to 2108 EDT

Attachment 2 – GFA valid for the accident site at accident time

Submitted by:

Paul Suffern
Senior Meteorologist

³² Inserted accident time for reference and context.