



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

March 17, 2022

Specialist's Factual Report

METEOROLOGY

ERA22LA060

A. ACCIDENT

Location: Wilkes-Barre, Pennsylvania
Date: November 14, 2021
Time: 1859 eastern standard time
2359 Coordinated Universal Time (UTC)
Aircraft: Cessna 150; Registration: N6714S

B. METEOROLOGY SPECIALIST

Specialist Paul Suffern
National Transportation Safety Board
Washington, DC

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 standard time (EST) and are based upon the 24-hour clock, where local time is -5 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 approximately at latitude 41.2385° N, Longitude 75.6895° W, at an approximate elevation of 1,965 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 northeast for 1900 EST is provided as figure 1 with the location of the accident site within the black circle. The chart depicted two low-pressure centers in southern Michigan and over Lake Erie with pressures at 1004- and 1003-hectopascals (hPa), respectively. Another low-pressure center was located just offshore eastern North Carolina with a pressure of 1011-hPa. A series of occluded frontal boundaries were located from western Pennsylvanian southwestward into the Tennessee Valley. The accident site was located east of the occluded frontal boundary in a region of southerly surface wind flow.

The station models around the accident site depicted air temperatures and dew point temperatures in the low to upper 30's degrees Fahrenheit (°F), with temperature-dew point spreads of 6°F or less, overcast skies, light snow, and a southerly wind around 5 knots.

¹ https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235

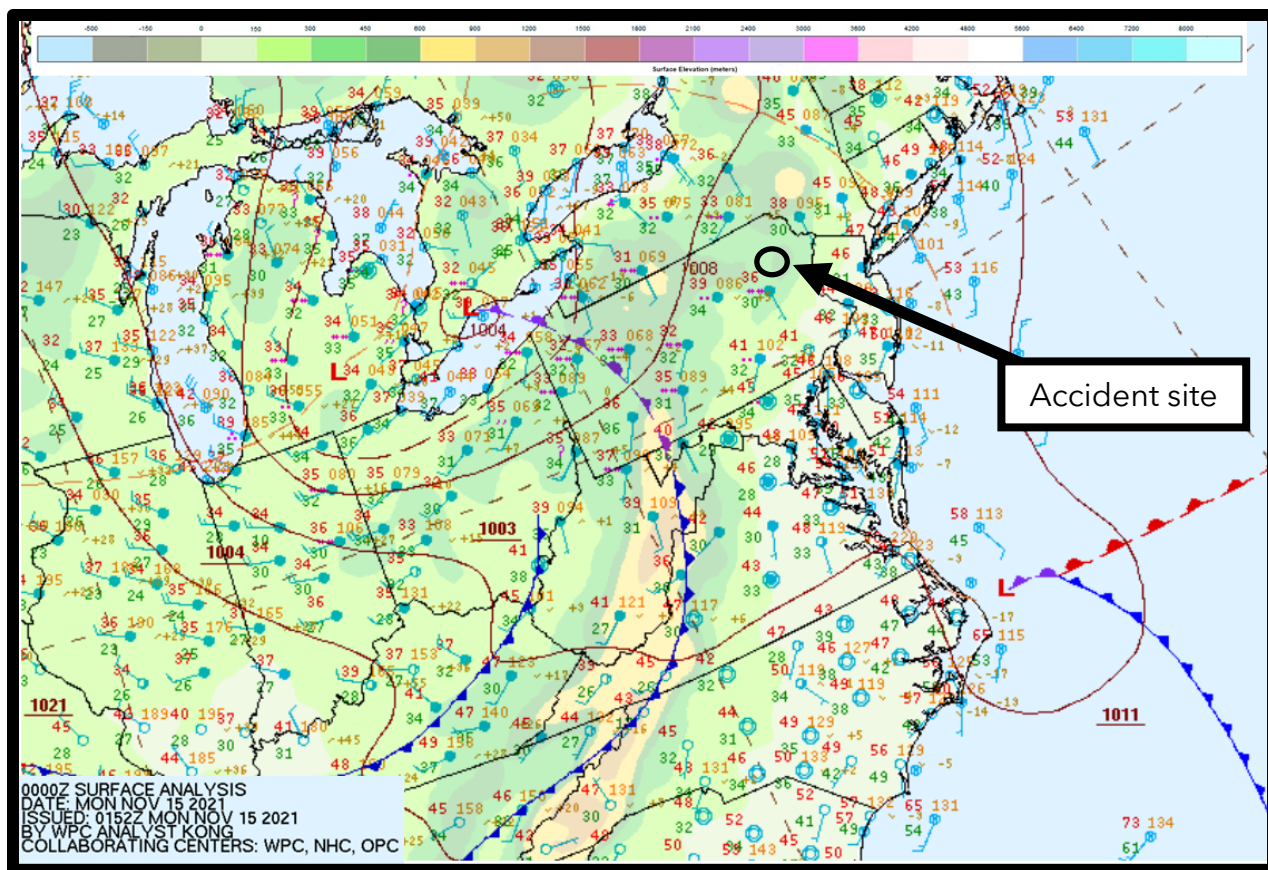
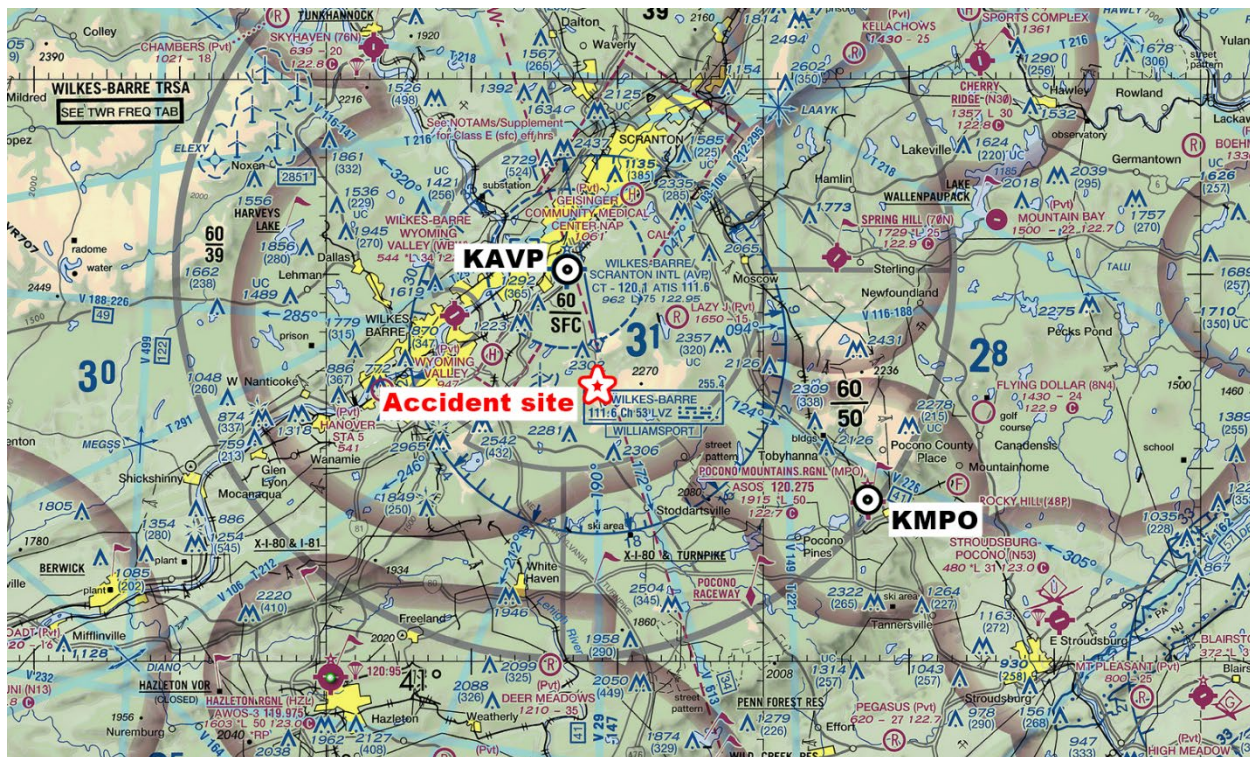


Figure 1. NWS Surface Analysis Chart for 1900 EST.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials Reports (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 2 is a local sectional chart with the accident site and the closest weather reporting locations marked. The chart depicted the magnetic variation² of 12° west over the area.

² Magnetic variation - The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>



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 (ATC). The KAVP ASOS was located 6 miles north-northwest of the accident site, at an elevation of 962 ft, and issued the following observations surrounding the period of the accident:⁵

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. ASOS are maintained by the NWS.

⁴ "Longline" refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases 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 weather observations are distributed.

⁵ 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.

[1454 EST] METAR KAVP 141954Z VRB06KT 10SM BKN120 07/M02
A2978 RMK AO2 SLPNO T00721017 \$=

[1554 EST] METAR KAVP 142054Z 20009KT 10SM BKN045 OVC100
07/M02 A2977 RMK AO2 SLP084 T00671022 58012=

[1654 EST] METAR KAVP 142154Z 18006KT 10SM SCT043 OVC090
06/M03 A2976 RMK AO2 SLP080 T00611028=

[1754 EST] METAR KAVP 142254Z 20008KT 10SM OVC044 06/M03
A2977 RMK AO2 SLP085 T00561028=

***[1854 EST] METAR KAVP 142354Z VRB06KT 10SM OVC041
05/M02 A2976 RMK AO2 SLP083 T00501022 10072 20050
56002=***

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***[1915 EST] SPECI KAVP 150015Z VRB04KT 10SM OVC044 05/M02
A2979 RMK AO2 RAB05E11 P0000 T00501017=***

[1954 EST] METAR KAVP 150054Z 20005KT 10SM -RA BKN035 OVC050
04/M01 A2977 RMK AO2 RAB05E11B44 SLP086 P0000 T00441006=

The bold type observations decoded in plain language were as follows:

KAVP weather at 1854 EST, variable wind at 6 knots, visibility 10 miles or more, overcast ceiling⁶ at 4,100 ft above ground level (agl), temperature of 5°C, dew point temperature -2°C, and an altimeter setting of 29.76 inches of mercury (inHg). Remarks, automated station with a precipitation discriminator, sea level pressure 1008.3 hPa, temperature 5.0°C, dew point temperature -2.2°C, 6-hourly maximum temperature of 7.2°C, 6-hourly minimum temperature of 5.0°C, 3-hourly pressure tendency decrease of 0.2 hPa.

KAVP weather at 1915 EST, variable wind at 4 knots, visibility 10 miles or more, overcast ceiling at 4,400 ft agl, temperature of 5°C, dew point temperature -2°C, and an altimeter setting of 29.79 inHg. Remarks, automated station with a precipitation discriminator, rain began at 1905 EST and ended at 1911 EST, a trace of precipitation since 1854 EST, temperature 5.0°C, dew point temperature -1.7°C.

⁶ Ceiling is defined as the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based observation.

The next closest official weather station to the accident site was Pocono Mountains Regional Airport (KMPO) and was also the intended destination airport. KMPO had an ASOS whose longline reports were not augmented. The KMPO ASOS was located 15 miles east-southeast of the accident site at an elevation of 1,915 ft. KMPO ASOS observations surrounding the accident time are shown below:

[1633 EST] SPECI KMPO 142133Z AUTO 16007KT 10SM OVC028
02/M02 A2975 RMK AO2 T00221022=

[1653 EST] METAR KMPO 142153Z AUTO 16006KT 10SM SCT026
OVC034 02/M02 A2975 RMK AO2 SLP092 T00221022=

[1730 EST] SPECI KMPO 142230Z AUTO 16007KT 10SM OVC029
02/M03 A2975 RMK AO2 T00221028=

[1753 EST] METAR KMPO 142253Z AUTO 17008G16KT 10SM OVC027
02/M03 A2975 RMK AO2 SLP093 T00171028=

***[1853 EST] METAR KMPO 142353Z AUTO 16007KT 10SM OVC026
02/M02 A2974 RMK AO2 SLP090 T00171022 10039 20017
58005=***

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***[1935 EST] SPECI KMPO 150035Z AUTO 17007KT 10SM SCT025
OVC036 02/M02 A2974 RMK AO2 T00171022=***

[1953 EST] METAR KMPO 150053Z AUTO 18006G16KT 10SM UP
BKN024 BKN028 OVC037 02/M02 A2975 RMK AO2 UPB43 SLP090
P0000 T00171022=

[2028 EST] SPECI KMPO 150128Z AUTO 18008KT 4SM -SN BR FEW009
BKN014 OVC022 01/M01 A2973 RMK AO2
UPE0055RAB0055E10SNB10 P0000 T00061006=

The bold type observations decoded in plain language were as follows:

KMPO weather at 1853 EST, automated, wind from 160° at 7 knots, visibility 10 miles or more, overcast ceiling at 2,600 ft agl, temperature of 2°C, dew point temperature -2°C, and an altimeter setting of 29.74 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure 1009.0 hPa, temperature 1.7°C, dew point temperature -2.2°C, 6-hourly maximum temperature of 3.9°C, 6-hourly minimum temperature of 1.7°C, 3-hourly pressure decrease of 0.5 hPa.

KMPO weather at 1935 EST, automated, wind from 170° at 7 knots, visibility 10 miles or greater, scattered clouds at 2,500 ft agl, overcast ceiling at 3,600 ft agl, temperature of 2°C, dew point temperature -2°C, and an altimeter setting of 29.74 inHg. Remarks, automated station with a precipitation discriminator, temperature 1.7°C, dew point temperature -2.2°C.

The observations from KAVP and KMPO surrounding the accident time indicated VFR⁷ to MVFR conditions with precipitation reported at the surface after the accident time.

3.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)⁸ model sounding was created for the approximate accident site coordinates for 1900 EST with a surface elevation of 1,972 ft.⁹ The 1900 EST HRRR sounding was plotted on a standard Skew-T Log P diagram¹⁰ with the derived stability parameters included in figure 3 with data from the surface to 700-hPa (or approximately 10,000 ft). These data were analyzed using the RAOB¹¹ software package. The sounding depicted the lifted condensation level (LCL)¹² at 3,814 ft and the convective condensation level (CCL)¹³ at 4,995 ft. The freezing level was located at 2,859 ft. The precipitable water value was 0.41 inches.

⁷ 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.

⁸ 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.

⁹ HRRR sounding was created using NOAA Air Resource Laboratory:

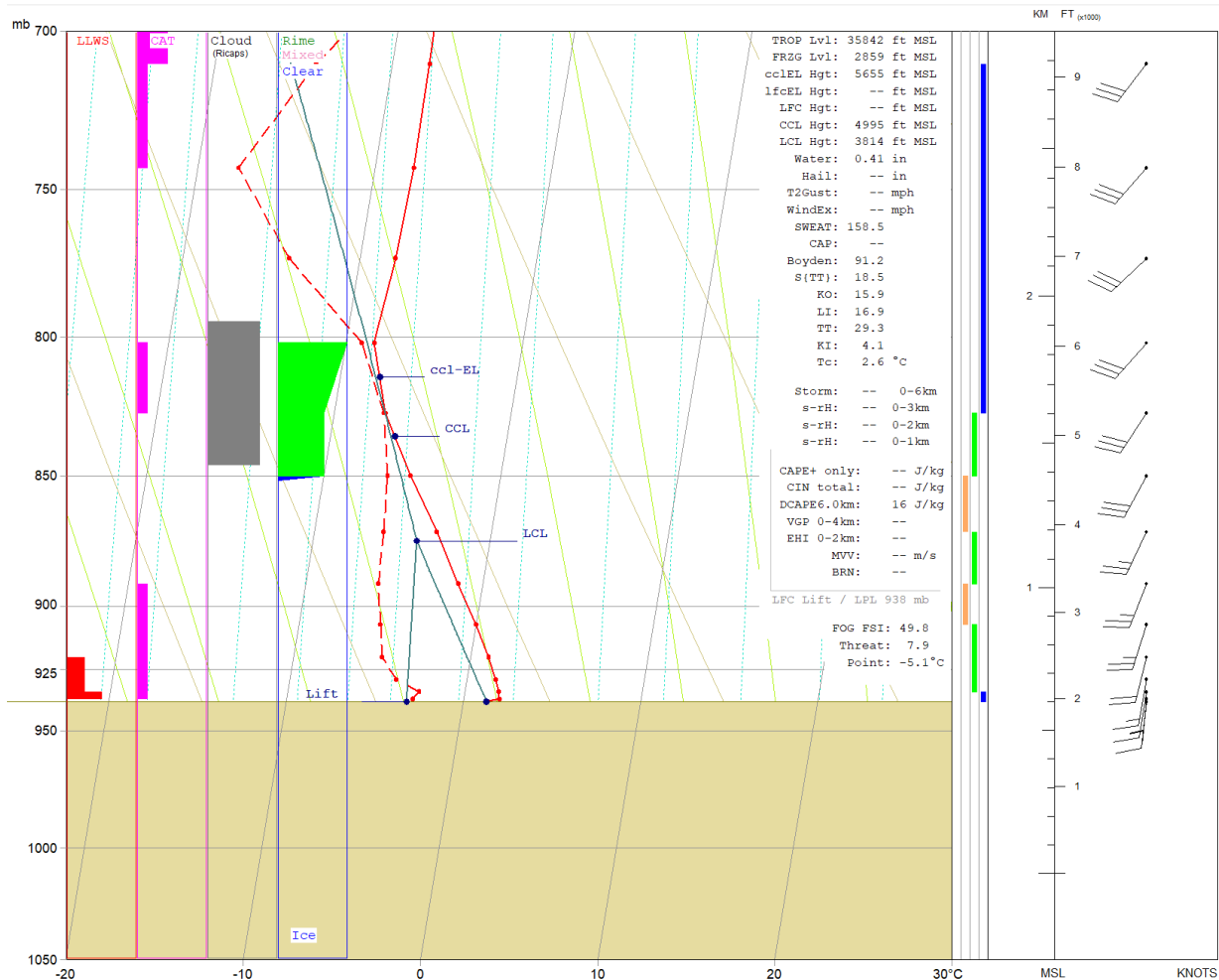
<https://ready.arl.noaa.gov/READYamet.php>

¹⁰ 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.

¹¹ RAOB - (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Esonde Research Services, The Villages, Florida.

¹² LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹³ 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.



The 1900 EST HRRR sounding for the accident site indicated a conditionally unstable environment from near the surface through 5,000 ft. Clouds were indicated by RAOB to be present from 5,000 ft through 6,500 ft. Moderate rime icing was indicated by RAOB between 5,000 and 6,000 ft.

The 1900 EST HRRR sounding wind profile indicated a near surface wind from around 190° at 8 knots with the wind veering¹⁴ to the southwest by 5,000 ft. The wind speed increasing to 25 knots by 3,000 ft and remained near 30 knots above 4,500 ft. RAOB indicated the possibility of light to moderate low-level wind shear (LLWS) below 1,000 ft agl, and light clear air turbulence in several layers below 10,000 ft.

¹⁴ A clockwise turning of the wind with height in the northern hemisphere.

4.0 National Radar Imagery

A regional view of the NWS National Reflectivity Mosaic is included as figure 4 for 1900 EST with the approximate location of the accident site marked by a red circle. The image depicted echoes from 10 to 35 decibels (dBZ¹⁵) above the accident site.

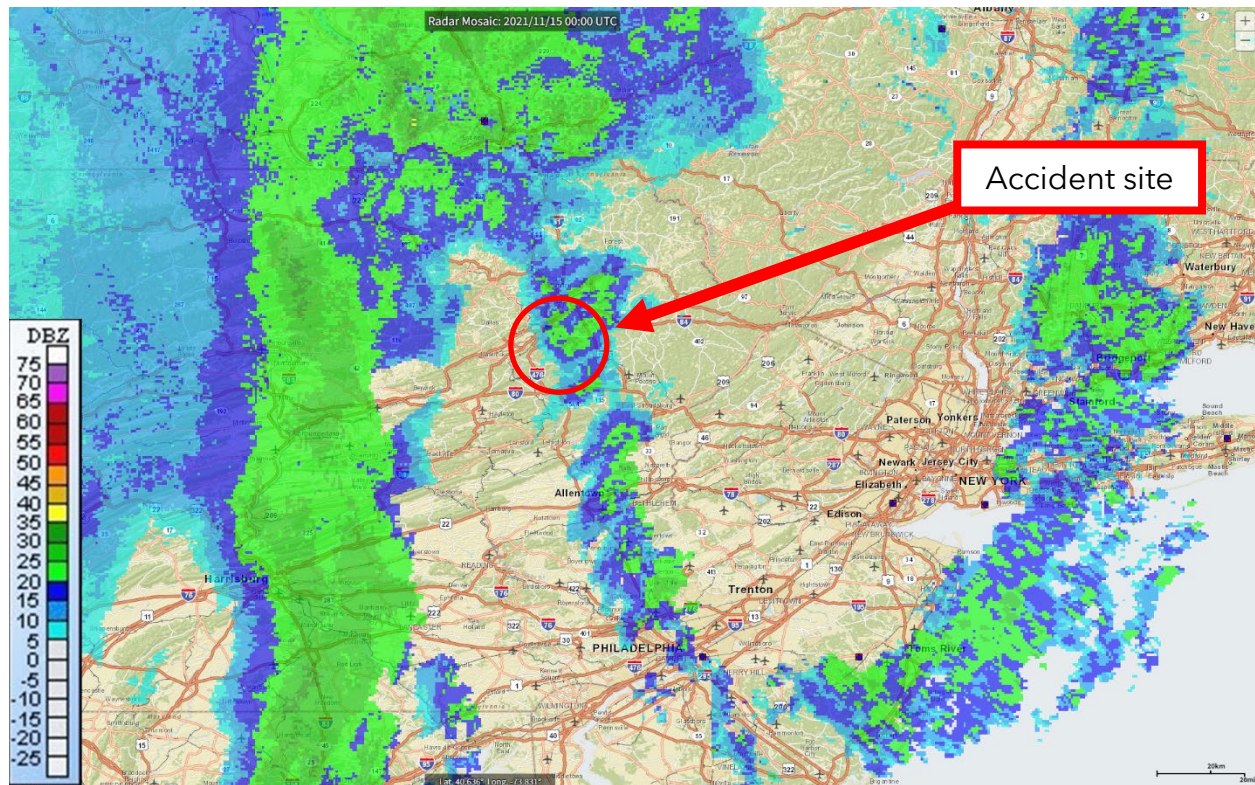


Figure 4. National Reflectivity Mosaic for 1900 EST.

5.0 Weather Surveillance Radar Imagery

The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)¹⁶ to the accident site was Binghamton, New York (KBGM) located 59 miles north-northwest of the accident site. 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.

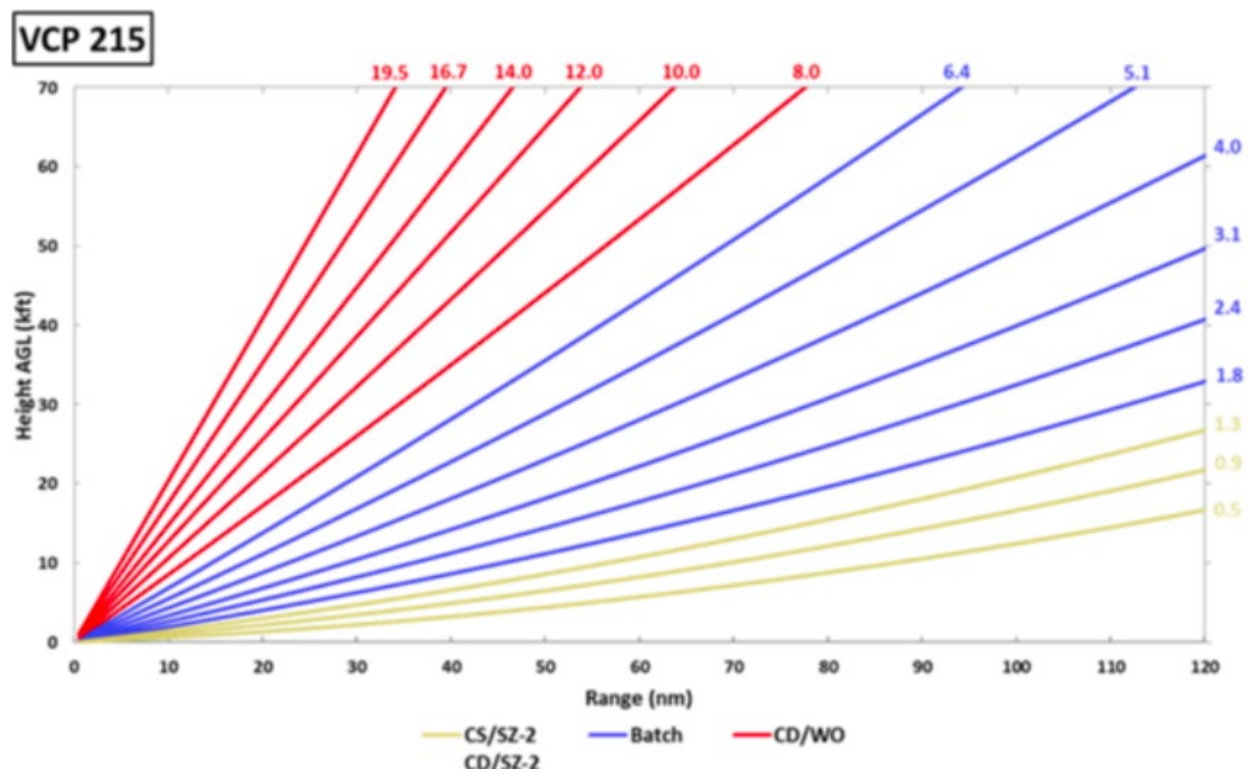
¹⁵ dBZ – A non-dimensional “unit” of radar reflectivity which represents a logarithmic power ratio (in decibels or dB) with respect to radar reflectivity factor, Z.

¹⁶ 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.

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

The WSR-88D operates in two main different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan where the radar makes 15 elevation scans from 0.5° to 19.5° every six minutes. This particular scanning strategy is documented as volume coverage pattern 215 (VCP-215, figure 5). Mode B is the clear-air mode, where the radar makes 5 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 figure 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.



¹⁷ 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

5.2 Beam Height Calculation

Assuming standard refraction¹⁸ of the KBGM WSR-88D radar beam with the antenna elevation at 1,703 ft, and considering a beamwidth¹⁹ of 0.95°, the following table shows the approximate heights for the radar beam center, top and base for antenna elevations over the accident site. These heights have been rounded to the nearest 10 ft.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP
KBGM 0.5°	7,350 ft	4,440 ft	10,260 ft

Based on the radar height calculations, the elevation scans from KBGM listed in the above table depicted the conditions between 4,440 ft and 10,260 ft over the accident site and these scans "saw" the closest altitudes to the ground.

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)

¹⁸ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

¹⁹ Beamwidth - the angular separation between the half power points on the antenna radiation pattern, where the gain is one half the maximum value.

5.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors²⁰ 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 00-24C²¹, "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."

5.4 Base Reflectivity and Lightning Data

Figures 6 through 9 present the KBGM WSR-88D base reflectivity images for the 0.5° elevation scans initiated at 1831:13, 1849:05, 1854:54, and 1900:41 EST, respectively, with a resolution of 0.5° X 250 m. Reflectivity values between 5 and 25 dBZ were located above the accident site at the accident time and indicative of very light to light precipitation (section 5.3). The band of precipitation was moving from southwest to northeast with time (attachment 1).

There were no lightning flashes²² within 50 miles of the accident site within 30 minutes prior to or following the accident time.²³

²⁰ 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.

²¹

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

²² 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.

²³ A review of Earth Networks Total Lightning network and GOES-16 Geostationary Lightning Mapper was done.

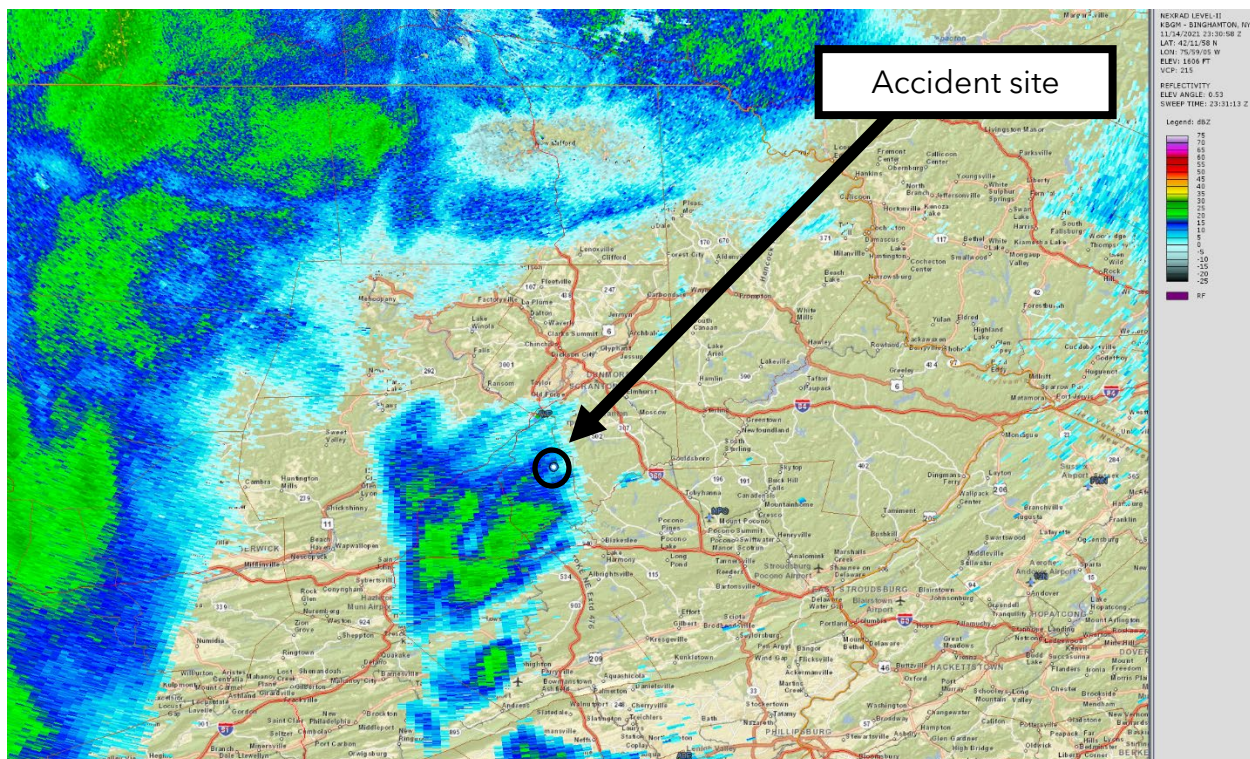


Figure 6. KBGM WSR-88D reflectivity for the 0.5° elevation scan initiated at 1831:13 EST with the accident site marked with black circle.

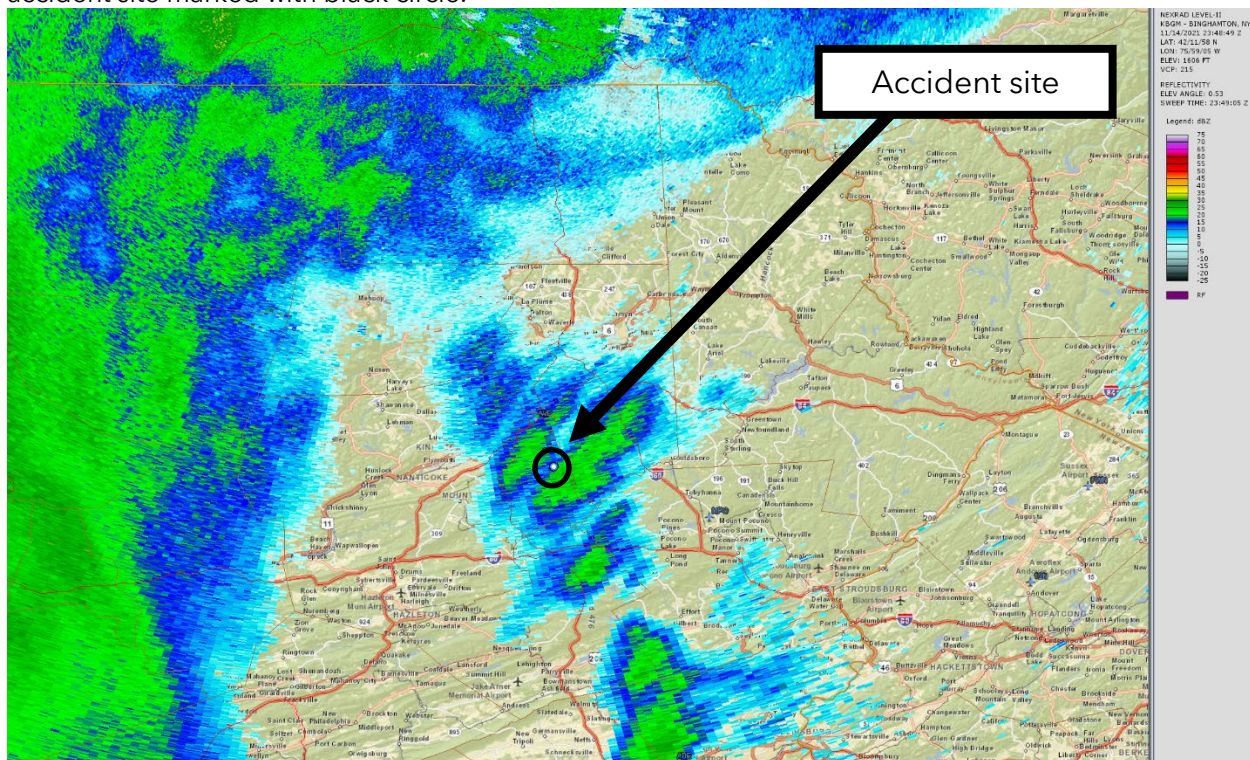


Figure 7. KBGM WSR-88D reflectivity for the 0.5° elevation scan initiated at 1849:05 EST with the accident site marked with black circle.

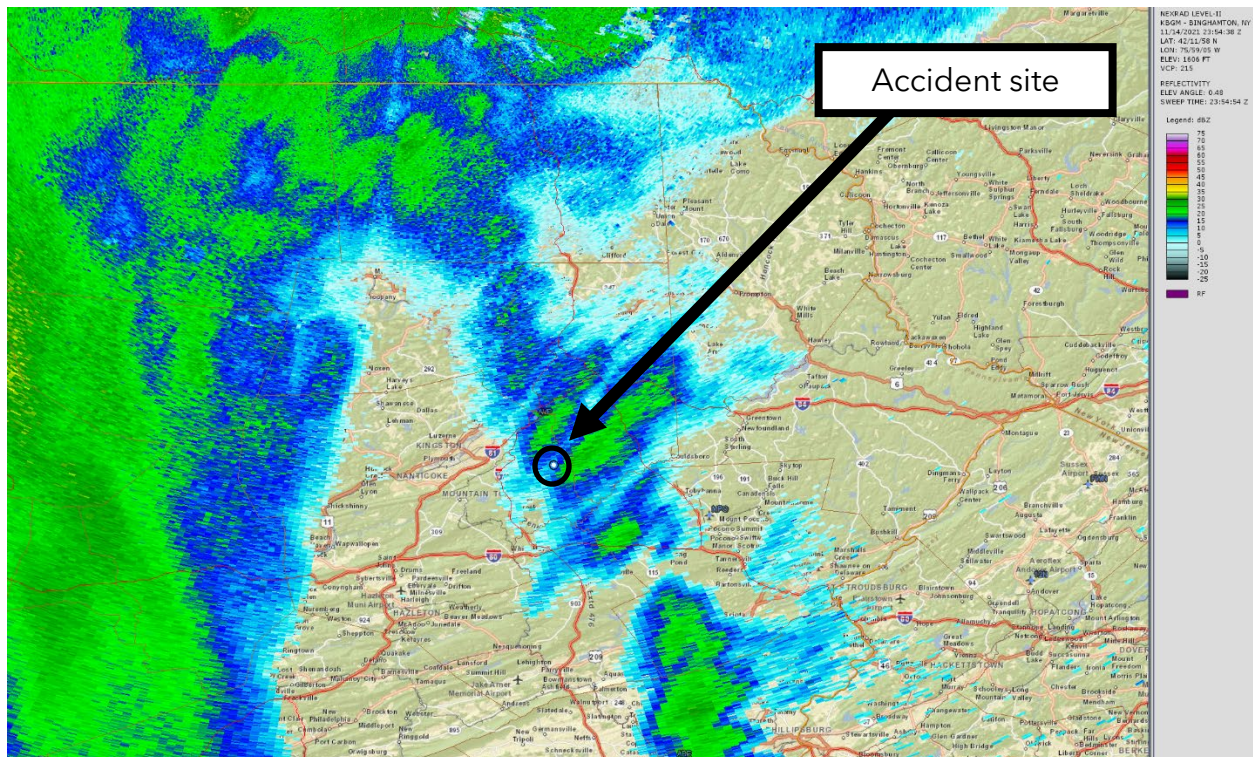


Figure 8. KBGM WSR-88D reflectivity for the 0.5° elevation scan initiated at 1854:54 EST with the accident site marked with black circle.

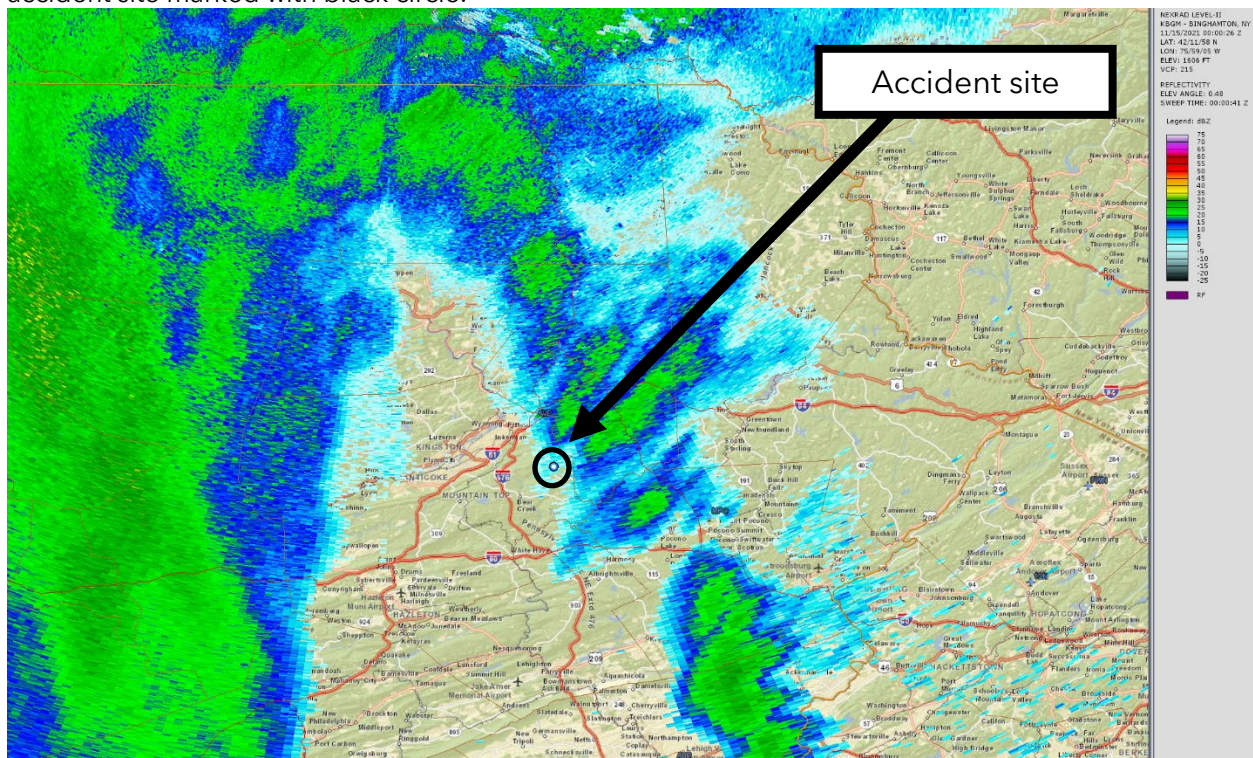


Figure 9. KBGM WSR-88D reflectivity for the 0.5° elevation scan initiated at 1900:41 EST with the accident site marked with black circle.

6.0 Pilot Reports

The longline-disseminated pilot reports²⁴ (PIREPs) distributed into the national airspace (NAS) were reviewed for about two hours either side of the accident time and the PIREPs within 80 miles of the accident site below 18,000 ft are shown below:

BGM UUA /OV BGM150020/TM 2257/FL060/TP PC12/TA M04/IC LGT MX 060=

EWR UA /OV SAX180010/TM 2304/FL160/TP C68A/TA -3/IC MODERATE RIME=

MGJ UA /OV HUU030020/TM 2336/FL160/TP B739/TA M18/IC LGT RIME/RM DURD 160-105=

ABE UA /OV ETX/TM 0010/FL090/TP B58T/WX IMC/TA M04/TB SMOOTH/IC MOD RIME=

CDW UA /OV CDW/TM 0105/FL150/TP E75S/TA -14/TB MOD CHOP/IC LIGHT RIME=

EWR UA /OV BWZ/TM 0113/FL070/TP B738/TA M08/IC LGT=

EWR UA /OV MMU240/010/TM 0120/FL060/TP E170/TA M010/IC LGT RIME=

PNE UA /OV ARD/TM 0120/FL100/TP CRJ7/TA 0/IC LGT RIME =

AVP UA /OV AVP/TM 0150/FL030/TP CRJ2/IC NEG/RM BASES=

AVP UA /OV AVP044004/TM 0155/FL030/TP CRJ2/SK OVC030/RM VIS 4SM =

7.0 Significant Meteorological Information

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

8.0 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 (CWAs) valid from ZNY CWSU at the accident time.

²⁴ 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.

9.0 Airmen's Meteorological Information

There were Airmen's Meteorological Information (AIRMET) advisories Sierra and Zulu valid for the accident site at the accident time. AIRMET Sierra issued at 1545 EST forecast IFR conditions due to ceilings below 1,000 ft agl and visibility below 3 miles in precipitation and mist, and mountain obscuration conditions due to clouds, precipitation, and mist until 2200 EST, while AIRMET Zulu issued at 1445 EST forecast moderate icing conditions between the freezing level²⁵ and FL200²⁶:

WAUS41 KPCI 142045

WA1S

-BOSS WA 142045

AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 150300

.
**AIRMET IFR...ME NH VT NY LO NJ PA OH LE WV MD VA
FROM 40WSW YSC TO 50W BGR TO 30N ENE TO 20NE ALB TO 30SSE SAX TO
30WNW ETX TO 40SE EKN TO 20SSW BKW TO HNN TO CVG TO FWA TO 20SSE
DXO TO MSS TO 40WSW YSC
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.**

.
**AIRMET MTN OBSCN...ME NH VT NY PA WV MD VA
FROM 30SW YSC TO 70SE YSC TO 20N CON TO 20NE ALB TO 40NNE SAX TO
30W HAR TO 50S EKN TO 30SW BKW TO 20NE HNN TO JHW TO SYR TO MSS
TO 30SW YSC
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.**

.
OTLK VALID 0300-0900Z

AREA 1...IFR ME NH VT MA RI CT NY LO NJ PA OH LE WV MD VA AND
CSTL WTRS

BOUNDED BY 70NW PQI-40S BGR-30SW PVD-30SSE SAX-20ENE PSB-50S EKN-
20SSW BKW-50S AIR-50SSW APE-40WSW ROD-FWA-30SSE DXO-MSS-YSC-70NW
PQI

CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 09Z.

.
AREA 2...MTN OBSCN ME NH VT MA NY PA WV MD VA
BOUNDED BY 70NW PQI-50SW PQI-30W BGR-CON-20NNE ETX-30SE PSB-30E
BKW-20WSW BKW-50SSW AIR-JHW-SYR-MSS-YSC-70NW PQI
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG THRU 09Z.

....

WAUS41 KPCI 142045

WA1Z

-BOSZ WA 142045

AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 150300

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²⁵ Freezing level between the surface and 5,000 ft.

²⁶ 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 msl or agl.

AIRMET ICE...OH LE
FROM 20SSE DXO TO 30WSW HNN TO CVG TO FWA TO 20SSE DXO
MOD ICE BTN FRZLVL AND 140. FRZLVL SFC-020. CONDS DVLPG AFT 21Z.
CONDS CONTG BYD 03Z THRU 09Z.

.
**AIRMET ICE...ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA
NC AND CSTL WTRS
FROM 70NW PQI TO 50NNE PQI TO 110SSW YSJ TO 100ENE ACK TO 30NE
ACK TO 70ESE SIE TO 40N ORF TO 20SE VXV TO HNV TO 20SSE DXO TO
20WSW BUF TO 20ESE YYZ TO MSS TO 30ESE YSC TO 70NW PQI
MOD ICE BTN FRZLVL AND FL200. FRZLVL SFC-050. CONDS CONTG BYD 03Z
THRU 09Z.**

.
AIRMET ICE...MA RI CT NY NJ MD DE VA AND CSTL WTRS
FROM 100ENE ACK TO 130SSE HTO TO 80E ECG TO ORF TO 40N ORF TO
70ESE SIE TO 20NE ACK TO 100ENE ACK
MOD ICE BTN FRZLVL AND FL220. FRZLVL 040-080. CONDS ENDG 00-03Z.

.
OTLK VALID 0300-0900Z
AREA 1...ICE OH LE
BOUNDED BY 30SE ECK-FWA-CVG-HNN-CVG-FWA-30SE ECK
MOD ICE BTN FRZLVL AND 100. FRZLVL SFC-020. CONDS DVLPG AFT 06Z.
CONDS CONTG THRU 09Z.

.
AREA 2...ICE ME NH VT MA NY LO PA OH LE WV MD VA AND CSTL WTRS
BOUNDED BY 40E YSC-50ENE ENE-20WSW BOS-20N BDL-20E HNK-60ESE
SLT-20N CSN-40NE PSK-40SW BKW-HNN-CVG-FWA-DXO-20WNW JHW-30N
BUF-40N SYR-MSS-60E MSS-40E YSC
MOD ICE BTN FRZLVL AND 140. FRZLVL SFC-020. CONDS CONTG THRU 09Z.

.
FRZLVL...RANGING FROM 010-100 ACRS AREA
MULT FRZLVL 040-100 BOUNDED BY 160ENE ACK-180SE ACK-20SW SIE-
50S ETX-160ENE ACK
SFC BOUNDED BY 20E JHW-20E SLT-50S JHW-20E JHW
040 ALG HNV-DCA-20ENE CYN-ACK-150ENE ACK
080 ALG 70E ORF-160SSE HTO-140SSE ACK-160ESE ACK

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10.0 Terminal Aerodrome Forecast

KAVP was the closest airport to the accident site with an NWS Terminal Aerodrome Forecast²⁷ (TAF). The KAVP TAF valid at the time of the accident was issued at 1830 EST and was valid for a 24-hour period beginning at 1900 EST. The 1830 EST TAF for KAVP was as follows:

TAF KAVP 142330Z 1500/1524 **19005KT P6SM OVC035**
TEMPO 1501/1504 3SM -SHRA BR OVC025
FM150600 21006KT P6SM OVC015
FM151300 24008G13KT P6SM BKN025
FM151700 28012G20KT P6SM BKN035=

Between 1900 EST and 0100 EST (November 15) the forecast expected a wind from 190° at 5 knots, greater than 6 miles visibility, and an overcast ceiling at 3,500 ft agl. Precipitation and mist were expected after 2000 EST.

KAVP TAF valid before departure was issued at 1220 EST and was valid for a 24-hour period beginning at 1300 EST. The 1220 EST TAF for KAVP was as follows:

TAF KAVP 141720Z 1418/1518 **23006KT P6SM BKN035**
FM150000 20005KT P6SM BKN035
TEMPO 1500/1503 5SM -SHRA BR OVC015
FM150300 20006G11KT P6SM OVC025
FM151500 26010G20KT P6SM OVC035=

Between 1300 and 1900 EST the forecast expected a wind from 230° at 6 knots, greater than 6 miles visibility, and a broken ceiling at 3,500 ft agl. Precipitation was expected after 1900 EST.

11.0 National Weather Service Area Forecast Discussion

The NWS office in Binghamton, New York, (WFO BGM) was responsible for the public forecast in the region of the accident site. WFO BGM issued the following Area Forecast Discussion (AFD) at 1841 EST, the closest AFD to the accident time with an aviation section, that forecast MVFR conditions and mixed precipitation or snow and brief IFR conditions while in snow showers:

FXUS61 KBGM 142341
AFDBGM

Area Forecast Discussion

²⁷ According to NWS Instruction 10-813: "An 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

National Weather Service Binghamton NY
641 PM EST Sun Nov 14 2021

.SYNOPSIS...

A frontal boundary with an area of low pressure will move through the Great Lakes tonight bringing some rain and snow showers. Despite this system moving east of the region, lake effect lingers early this week. A brief break is anticipated with high pressure over the region by the middle of the week.

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.NEAR TERM /THROUGH MONDAY NIGHT/...
630 PM Update...

The forecast remains on track this evening, with rain overspreading the area. Evaporational cooling is helping to quickly drop temperatures to the lower to mid 30s in the Twin Tiers, with a change over to a rain/snow mix or pellets. However, dewpoints are coming in higher across the Finger Lakes northward through Oneida county, so some spots may stay warm enough to see mostly rain overnight.

Afternoon discussion continues below.

An area of low pressure with a frontal boundary will move the Great Lakes into our region then move northeast of the region on Monday. Modeling is still fairly consistent with showers moving into the area around sunset. Evaporational cooling looks sufficient enough for the showers to mix with and change to snow in most locations given lower dewpoints compared to yesterday. This is what has been occurring this afternoon across western NY and PA with 35 a rough magic temperature between rain and snow.

Temperatures should fall to around freezing across most of the area overnight. Also, with colder air moving in aloft, most of what lingering precipitation is around should be mostly in the form of light snow showers. However, mesoscale modeling is keying in on a pronounced dry slot during the mid and late evening hours which is reflected in the pops. Snow will have a hard time accumulating on the warmer ground particularly in lower elevations, so took ratios down to 5:1 for those locations. Still, some higher elevations could end up with a slushy inch or so of wet snow.

Monday our region gets into west and northwest flow off lakes Ontario and Erie bringing in more clouds across the region with perhaps a few peaks of sun in NE PA. A slight amount of instability looks to be present in the afternoon hours enough for a few convective rain or snow showers throughout most of the day. Lake Ontario should enhance some of this activity downwind into the NY Thruway corridor and the higher elevations a bit south of Syracuse. Some graupel is not out of the question either.

Temperatures should rebound to around 40, limiting any snow accumulation during the day. However, temperatures fall back to and below freezing Monday night. Lake effect precipitation should continue but wind direction looks to be a bit more variable than ideal for sustained lake effect snowfall. Still another inch or so in a few of the traditionally favored spots can not be ruled out.

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.SHORT TERM /TUESDAY THROUGH TUESDAY NIGHT/...

With 850mb temperatures remaining around -6C and a west-southwesterly flow, additional scattered lake effect rain and snow showers will be possible on Tuesday, mainly along and north of the NY Thruway corridor. However, with an upper level ridge and surface high pressure moving in from the west, the coverage of these showers will be quickly diminishing and likely ending completely in the afternoon. Any snow accumulations will be light due to the relatively warm ground and surface air temperatures, likely only a tenth or two north of the NY Thruway corridor. Aside from lingering lake effect clouds across these areas, partly to mostly sunny skies are expected elsewhere. Highs are expected to be in the lower to mid 40s.

High pressure quickly moves east of the area Tuesday night as a warm front approaches the area from the southwest. After a mostly clear start to the night, clouds will begin to increase from west to east late Tuesday night/early Wednesday morning. These increasing clouds will prevent temperatures from falling too much. Temperatures will likely fall into the upper 20s to lower 30s during the evening, before leveling off after midnight or so.

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.LONG TERM /WEDNESDAY THROUGH SUNDAY/...

Upper level ridging along with warm air advection will allow for above normal temperatures on Wednesday, with highs likely well into the 50s. Despite these mild temperatures, mostly cloudy skies are expected.

The latest 12Z guidance suite continues to slow down the approach of the next cold front on Thursday. Therefore, backed off on PoPs considerably Wednesday night and now only have PoPs in the forecast for Thursday. Due to the slower progression of the front, there continues to be a bit of uncertainty regarding high temperatures Thursday, but general trends have been warmer. Right now expecting highs in the 50s, but this is highly dependent on the timing of the front passage. Due to these mild temperatures, precipitation is expected to mainly in the form of rain, with snow perhaps mixing in Thursday night.

Behind the front the noticeable feature will be the sharp drop

in temperatures with highs Friday roughly 10-15 degrees colder with a brisk north westerly wind. This should be another setup for lake effect snow showers southeast of Lake Ontario.

With high pressure building behind the front, temps Friday night could be quite chilly by November standards with lows in the lower to mid 20s. Continued to go a few degrees below blended guidance due to the radiational cooling conditions expected. It is possible some teens may occur as well.

High pressure continues through Saturday, before uncertainty increases for the second half of the weekend into early next week with another system possible.

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.AVIATION /00Z MONDAY THROUGH FRIDAY/...

Mainly MVFR ceilings across the region this evening. Showers at the NY terminals are expected to mix with or change to snow over the next few hours and could bring brief IFR conditions in snow showers. Clipper system moves out after midnight along with the bulk of the precipitation. Ceilings should increase a bit, but mostly remain MVFR into tomorrow.

Outlook...

Monday night through Tuesday... Lake effect rain or snow showers will be possible at KRME and KSYR, lower chances for KITH and KBGM Monday through Tuesday.

Wednesday and Thursday...Mostly VFR. Some gusty southerly winds possible Wednesday afternoon then more westerly Thursday afternoon. Any restrictions look to hold off till Thursday with some showers around.

Thursday night and Friday: Ceilings likely to lower to at least MVFR levels at NY terminals with a chance for a few rain or snow showers.

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.BGM WATCHES/WARNINGS/ADVISORIES...

PA...None.

NY...None.

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12.0 Winds and Temperature Aloft Forecast

The NWS 1458 EST Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

FBUS31 KWNO 141958
FD1US1
DATA BASED ON 141800Z
VALID 150000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT 3000 6000 9000 12000 18000 24000 30000 34000 39000
AVP 2024 2327-07 2233-07 2242-10 2262-21 2281-33 720848 731753 239653

The closest forecast point to the accident site was KAVP (AVP). The 1458 EST AVP forecast for use between 1500 EST and 2200 EST indicated a wind at 3,000 ft from 200° at 24 knots, a wind at 6,000 ft from 230° at 27 knots with a temperature of -7°C, and a wind at 9,000 ft from 220° at 33 knots with a temperature of -7°C.

13.0 Pilot Weather Briefing

The accident pilot did not request weather information²⁸ from Leidos Flight Service.

A search of archived ForeFlight information indicated that the accident pilot did have a ForeFlight account and requested and received information via the ForeFlight App as late as 1848 EST, with several additional information requests and reviews (attachment 2). The accident pilot did not request a ForeFlight weather briefing. With no internet access while in flight, ForeFlight is still able to access weather information directly from the FAA, but leaving no remote record of such access. For more information please see attachment 2.

In addition, the accident pilot stated they reviewed weather in METARs, ASOS, Automatic Terminal Information Service (ATIS), and Model Output Statistics (MOS)²⁹ for the accident flight. For more information please see the Pilot's Input Provided by the FAA located in the docket for this accident.

²⁸ https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf

²⁹ [About MOS \(weather.gov\)](#)

14.0 Astronomical Data

The astronomical data obtained for the accident site on November 14, 2021, indicated the following:

SUN

Begin civil twilight	0620 EST
Sunrise	0649 EST
Sun transit	1147 EST
Sunset	1645 EST
End civil twilight	1714 EST
Accident time	1859 EST³⁰

MOON

Moonrise	1453 EST
Accident time	1859 EST
Moon transit	2051 EST
Moonset	0157 EST on November 15

At the time of the accident the Moon was located at an altitude of 39.09° and azimuth of 143.36° with 83.1% of the Moon's disk illuminated.

E. LIST OF ATTACHMENTS

Attachment 1 - KBGM weather radar animation from 1831 to 1912 EST

Attachment 2 - ForeFlight correspondence

Submitted by:

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Senior Meteorologist

³⁰ Inserted accident time for reference and context.