**NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety
Washington, D.C. 20594

November 15, 2021

**Specialist's Factual Report**

# METEOROLOGY

ERA21FA234

## Table Of Contents

## A. ACCIDENT

Location: Smyrna, Tennessee
Date: May 29, 2021
Time: 1055 central daylight time
1555 Coordinated Universal Time (UTC)
Airplane: Cessna 501; Registration: N66BK

## 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 central daylight time (CDT) 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 at latitude 36.0334° N, Longitude 86.4814° W, with an approximate elevation of 485 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 Tennessee Valley for 1000 CDT is provided as figure 1 with the location of the accident site within the red circle. The chart depicted a cold front stretching from Virginia southwestward through the Carolinas, Georgia, and into southern Alabama. Two low pressure systems with pressures of 1007-hectopascals (hPa) were located in western North Carolina and southern Virginia along the cold front. The accident site was located north and west of the cold front on the cool side of the front.

The station models around the accident site depicted air temperatures in the mid 50's degrees Fahrenheit (°F), dew point temperatures in the low 50's °F with temperature-dew point spreads of 6°F or less, a northwest wind at 10 knots, and cloudy skies.

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

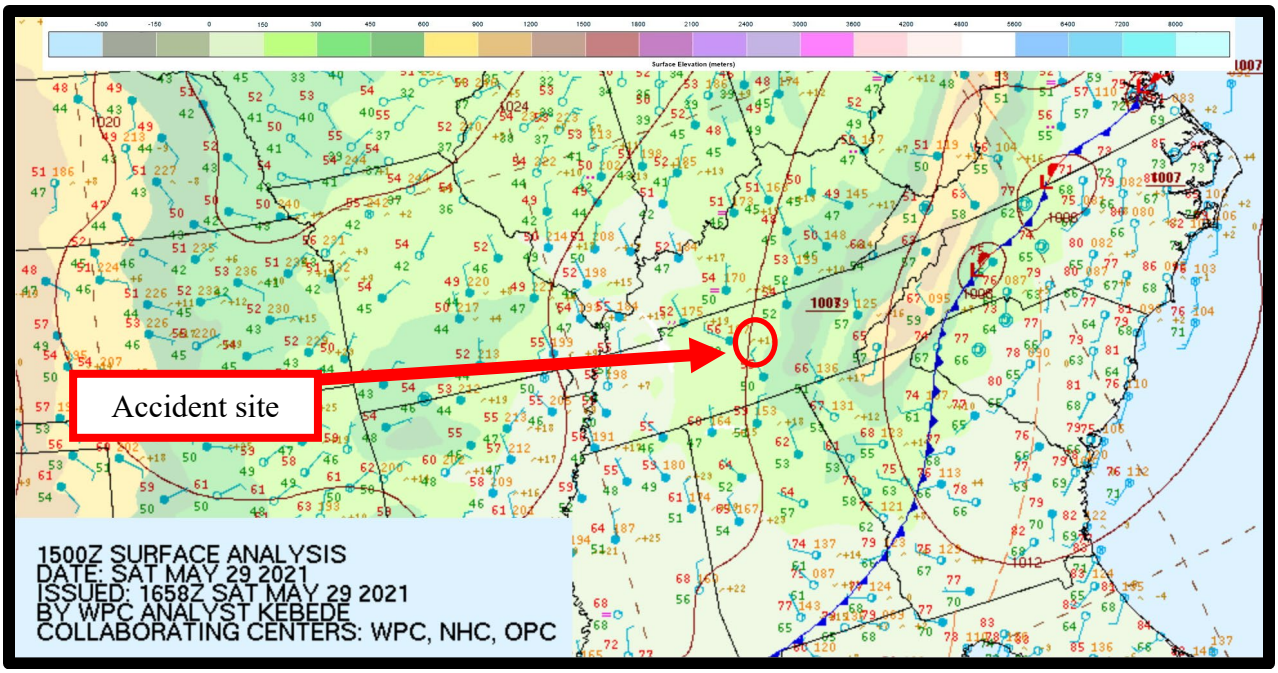



**Figure 1 – NWS Surface Analysis Chart for 1000 CDT.**

## 1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0700 CDT at 925-, 850- and 700- hectopascals (hPa) are presented in figures 2 through 4. The accident site was located below a low- and mid-level trough[2] at 850- and 700-hPa (figures 3 and 4). Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. There was a northwest wind at 5 knots at 925-hPa with the wind remaining northwesterly at 20 knots by 700-hPa.

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

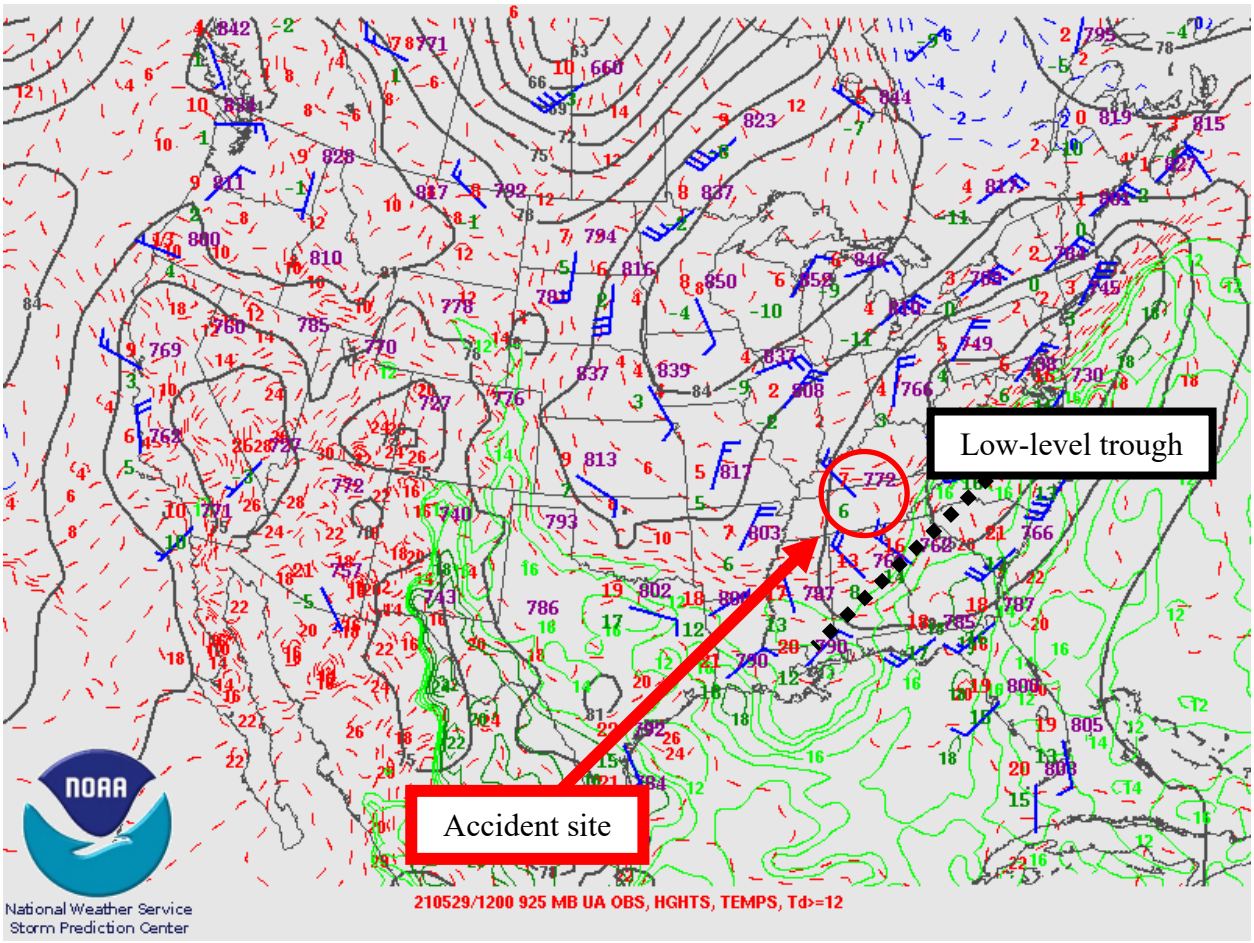



**Figure 2 – 925-hPa Constant Pressure Chart for 0700 CDT.**

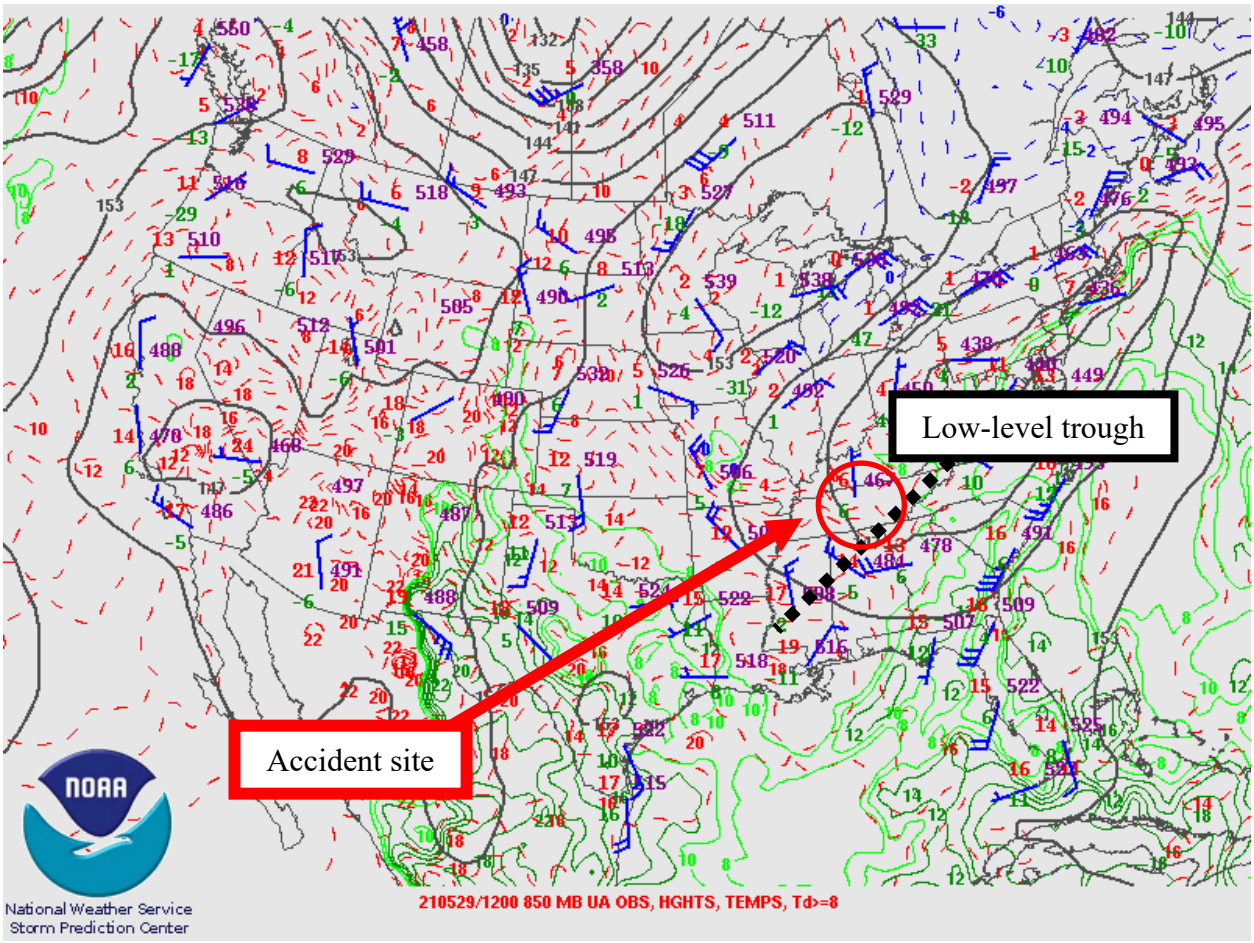



**Figure 3 – 850-hPa Constant Pressure Chart for 0700 CDT.**

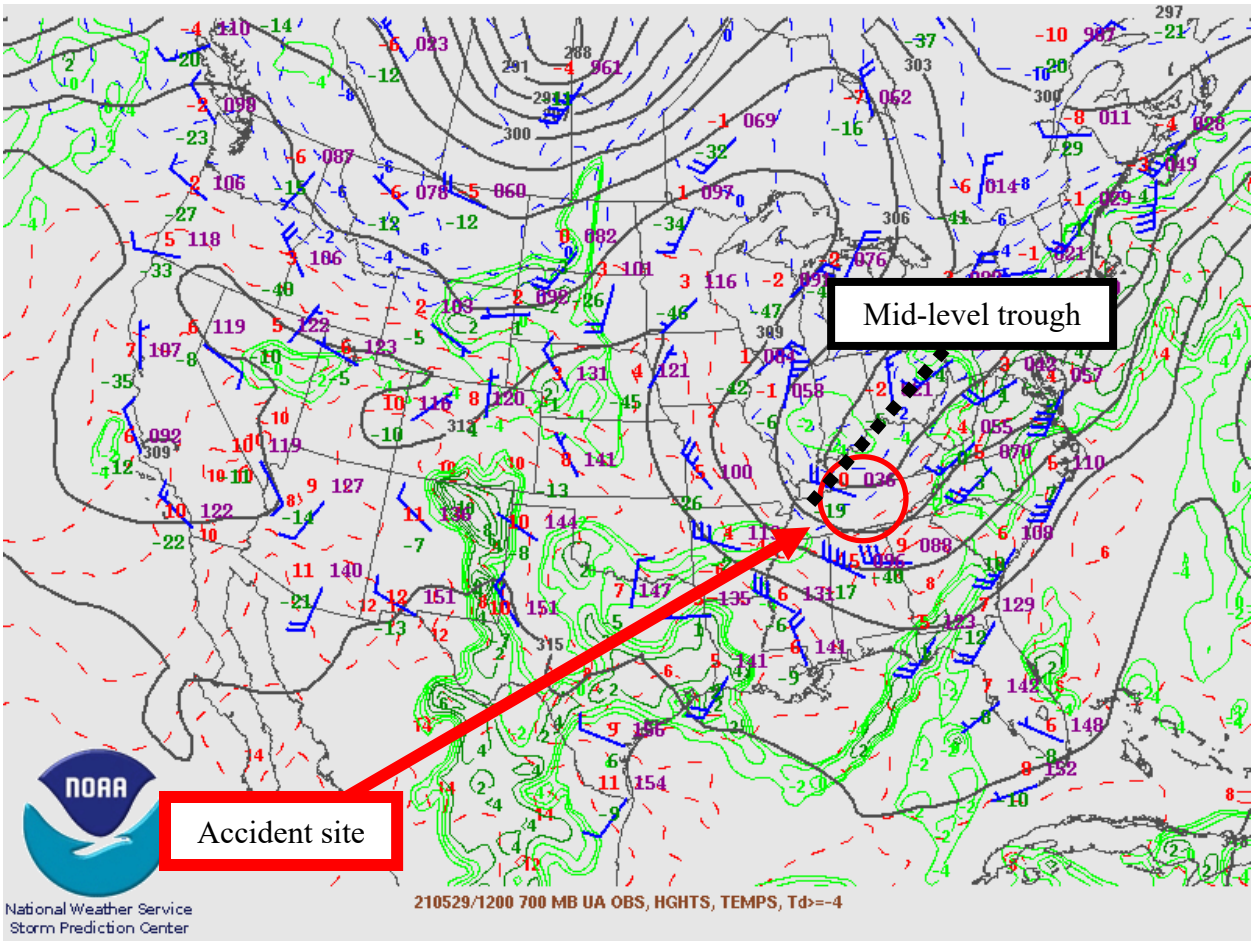



**Figure 4 – 700-hPa Constant Pressure Chart for 0700 CDT.**

## 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 location marked.


**Figure 5 – Sectional map of the accident area with the locations of the accident site and surface observation site.**

Smyrna Airport (KMQY), the departure airport, had the closest official weather station to the accident site. KMQY had an Automated Weather Observing System (AWOS[3]) who's longline[4] reports were augmented by air traffic control (ATC) when the tower was in operation[5]. The KMQY AWOS was located 2 miles southwest of the accident site, at an elevation of 543 ft, and had a 4° westerly magnetic variation[6] (figure 5). The following automated longline observations were disseminated during the times surrounding the accident:[7]

[3] AWOS – Automated Weather Observing System is equipped with meteorological instruments to observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to 12,000 feet, and altimeter setting. AWOS are maintained by the FAA.

[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 between 0700 and 2200 local on the weekdays and between 0700 and 1900 local on the weekends.

[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.

[0656 CDT] KMQY 291156Z 30011KT 10SM OVC015 12/10 A2998 RMK AO2 SLP158 70067 T01220100 10139 20117 51008

[0704 CDT] KMQY 291204Z 31011KT 10SM OVC013 12/10 A2998 RMK AO2

[0756 CDT] KMQY 291256Z 30008KT 10SM OVC011 12/11 A3001 RMK AO2 SLP167 T01220106

[0856 CDT] KMQY 291356Z 31010KT 4SM BR OVC011 13/11 A3002 RMK AO2 SLP174 T01280111

***[0956 CDT] KMQY 291456Z 31011KT 10SM OVC013 14/11 A3003 RMK AO2 SLP177 T01390111 51017***

**ACCIDENT TIME 1055 CDT**

***[1056 CDT] KMQY 291556Z 31010KT 10SM OVC013 14/12 A3004 RMK AO2 SLP178 T01390117***

[1103 CDT] KMQY 291603Z 30011KT 10SM OVC013 14/12 A3004 RMK AO2

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

KMQY weather at 0956 CDT, wind from 310° at 11 knots, visibility 10 miles or greater, overcast ceiling 1,300 ft above ground level (agl), temperature of 14° Celsius (C), dew point temperature of 11°C, and an altimeter setting of 30.03 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, sea level pressure 1017.7 hPa, temperature of 13.9°C, dew point temperature of 11.1°C, 3-hourly pressure increase of 1.7 hPa.

KMQY weather at 1056 CDT, wind from 310° at 10 knots, visibility 10 miles or greater, overcast ceiling 1,300 ft agl, temperature of 14°C, dew point temperature of 12°C, and an altimeter setting of 30.04 inHg. Remarks: automated station with a precipitation discriminator, sea level pressure 1017.8 hPa, temperature of 13.9°C, dew point temperature of 11.7°C.

The observations from KMQY surrounding the accident time indicated MVFR[8] conditions with a cloud ceiling at 1,300 ft agl (~1,840 ft msl).

[8] 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

Nashville, Tennessee (KBNA) was the closest site with an upper air sounding and was located 11 miles west-northwest of the accident site at an elevation of 591 ft and had a station ID of 72327. The 0700 CDT KBNA sounding was plotted on a standard Skew-T Log P diagram[9] with the derived stability parameters included in figure 6 with data from the surface to 700-hPa (or approximately 10,000 ft msl). These data were analyzed using the RAOB[10] software package. The sounding depicted the lifted condensation level (LCL)[11] and the level of free convection (LFC)[12] at 749 ft agl (1,340 ft msl), and the convective condensation level (CCL)[13] at 2,363 ft agl (2,954 ft msl). The freezing level was located at 9,624 ft msl. The precipitable water value was 0.68 inches.

[9] 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.
[10] RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Eosonde Research Services, The Villages, Florida.
[11] LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.
[12] LFC – The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.
[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.

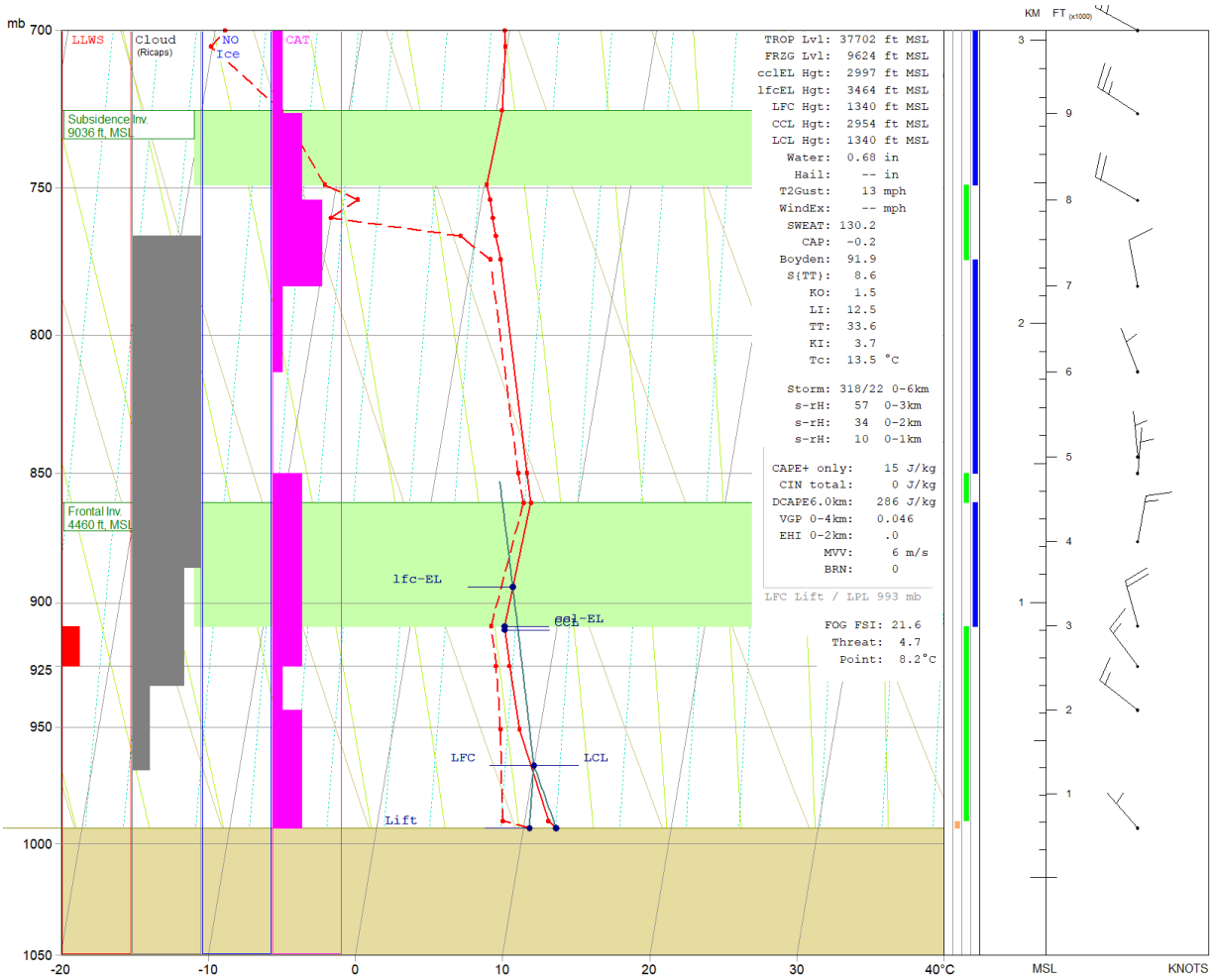



**Figure 6 – 0700 CDT KBNA sounding.**

The 0700 CDT KBNA sounding for the accident site indicated a conditionally unstable environment from the surface through 3,000 ft msl. A stable environment was in place between 3,000 ft and 4,500 ft msl below the frontal inversion[14] at 4,460 ft msl. A subsidence inversion was located at 9,036 ft msl. Clouds were indicated by RAOB to be present from 1,300 ft msl (~700 ft agl) through 8,000 ft msl. No icing potential was indicated by RAOB below 10,000 ft msl.

The 0700 CDT KBNA sounding wind profile indicated a near surface wind from 320° at 6 knots with the wind remaining out of the northwest to north through 10,000 ft msl. The wind speed increased to 15 knots by 2,000 ft msl with the wind speed to 30 knots by 10,000 ft msl. RAOB indicated the possibility of light low-level wind shear (LLWS) between 1,750 ft and 2,250 ft agl. RAOB indicated the possibility of light to moderate clear-air turbulence in several layers between the surface and 10,000 ft msl.

[14] Inversion – A departure from the usual decrease of the value of an atmospheric property with increasing altitude; also, the layer through which this departure occurs (the "inversion layer"), or the lowest altitude at which the departure is found (the "base of the inversion").

## 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 0830 CDT through 1300 CDT and reviewed, and the closest images to the time of the accident were documented.

Figure 7 presents the GOES-16 visible imagery from 1100 CDT at 2X magnification with the accident site highlighted with a red square. There was cloud cover above the accident site at the accident time with the cloud cover moving from north to south (attachment 1). Figure 8 presents the GOES-16 infrared imagery from 1100 CDT at 6X magnification with the accident site highlighted with a red square. The lower brightness temperatures (orange and red colors; higher cloud tops) were located above and to the west through east of the accident site. The brightness temperature of about 275 Kelvin above the accident site would have been near 7,300 ft msl based on the vertical temperature profile provided by the 1100 CDT KBNA sounding. It should be noted these figures have not been corrected for any parallax error.

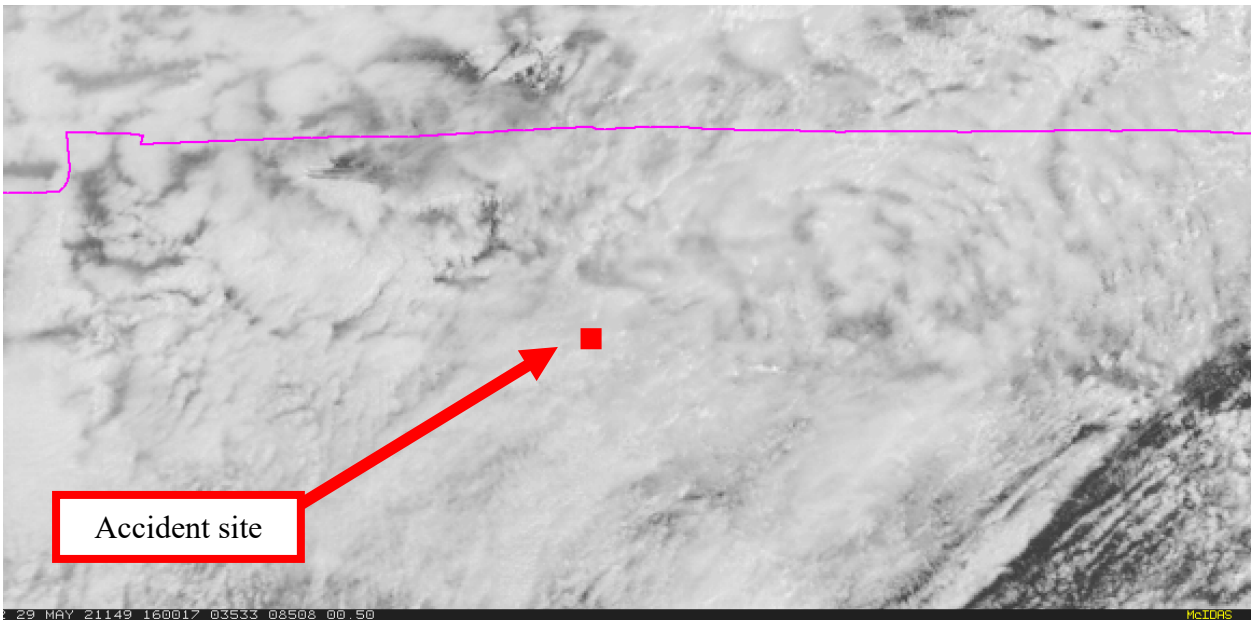



**Figure 7 – GOES-16 visible image at 1100 CDT.**

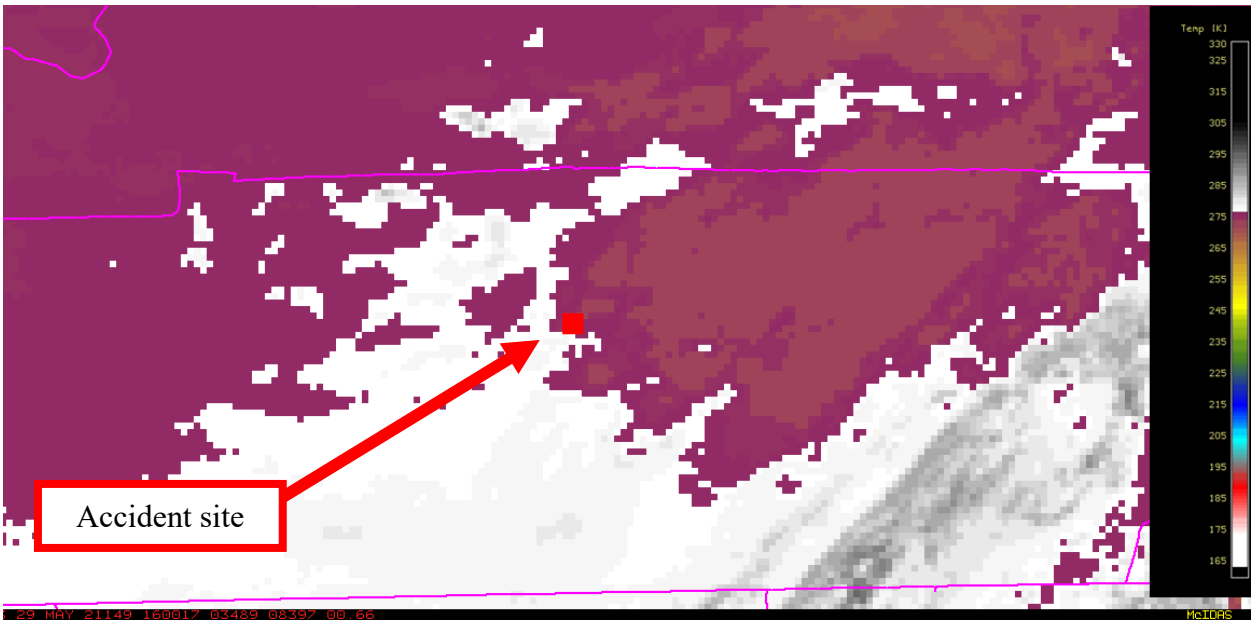



**Figure 8 – GOES-16 infrared image at 1100 CDT.**

## 5.0 Regional Radar Imagery Information

A regional view of the NWS national composite radar mosaic is included as figure 9 for 1055 CDT with the approximate location of the accident site marked within a red circle. The image depicted no echoes above the accident site at the accident time.

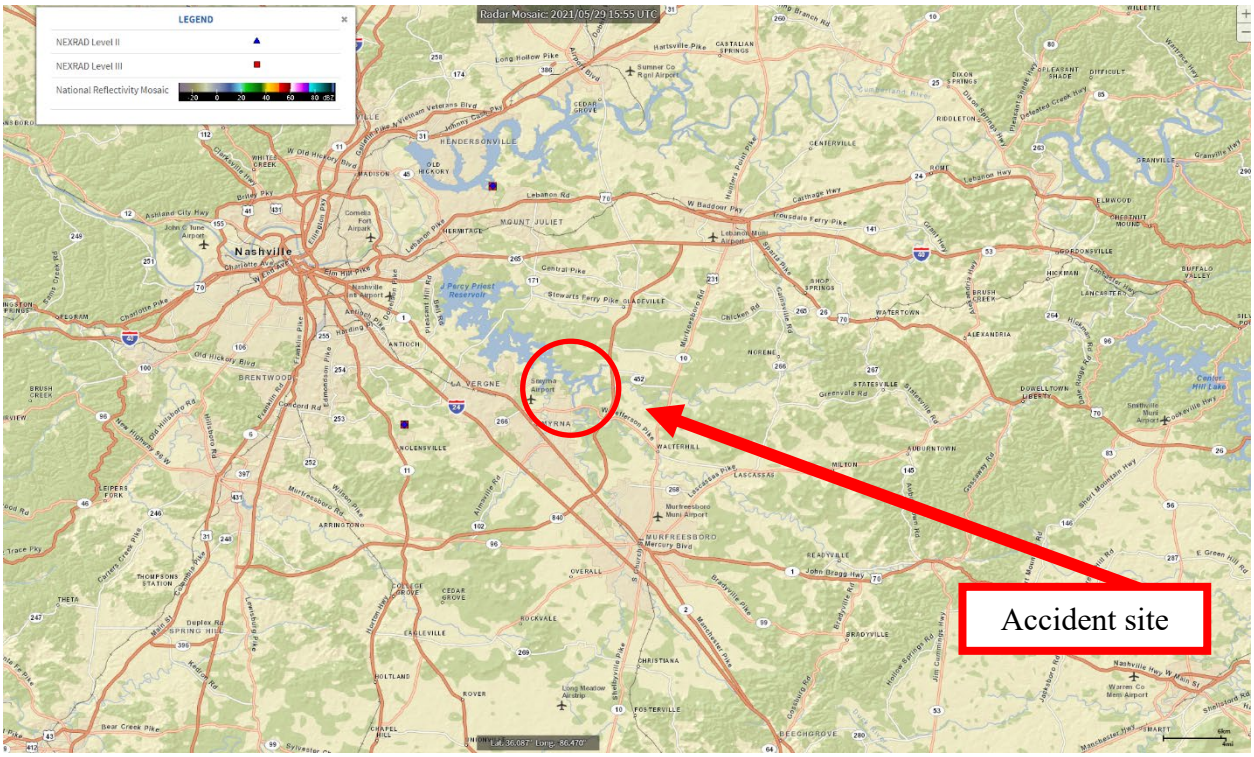



**Figure 9 – Regional Composite Reflectivity image for 1055 CDT.**

## 6.0 Radar Imagery Information

The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)[15] to the accident site was Nashville, Tennessee, (KOHX) located 13 miles northwest of the accident. 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.

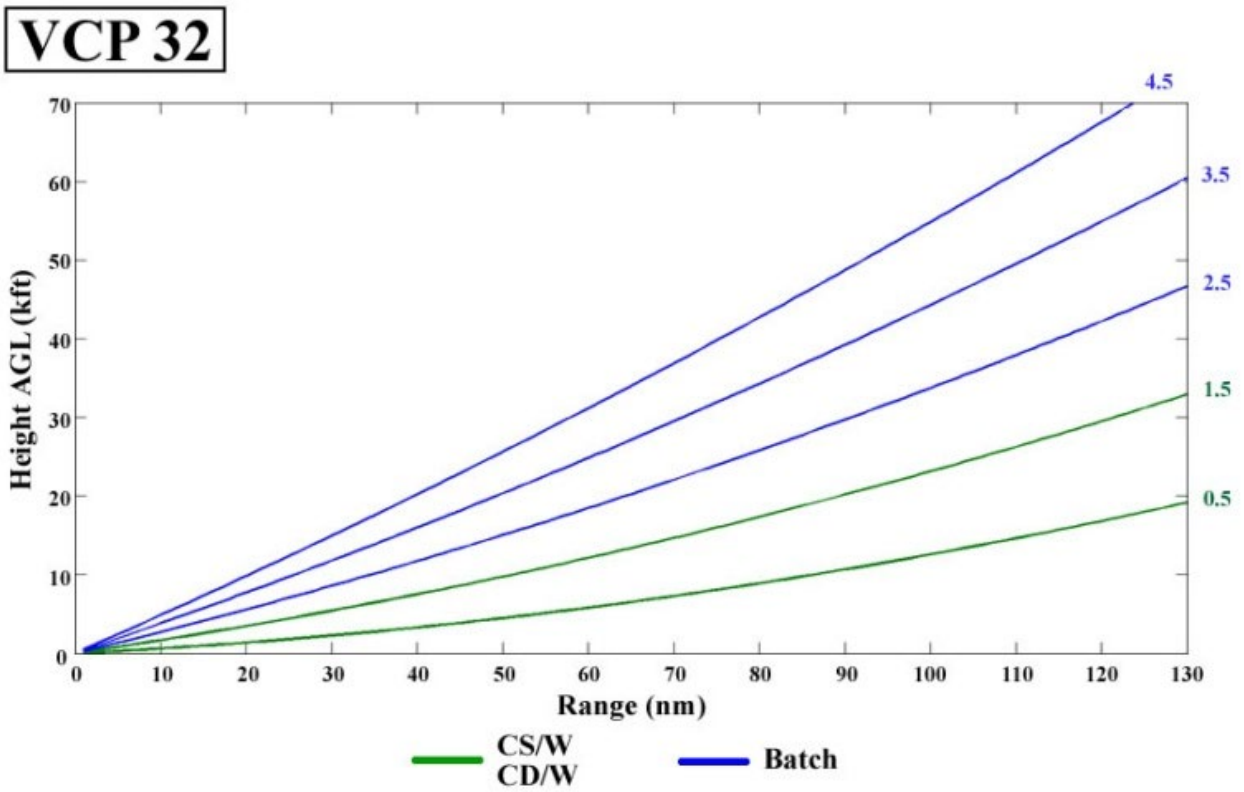
## 6.1 Volume Scan Strategy

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.

The WSR-88D operates in two different main scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has three common scanning strategies[16]. 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 KOHX radar was operating in the clear-air mode 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.

[15] 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.

[16] 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)




**VCP-32 Clear-air Mode Scan Strategy.**

## 6.2 Beam Height Calculation

Assuming standard refraction[17] of the KOHX radar beam with the antenna elevation at 676 ft, and considering a beamwidth[18] 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 |
|---|---|---|---|
| KOHX 1.5° | 2,860 ft | 2,220 ft | 3,500 ft |

Based on the radar height calculations, the elevation scan from KOHX listed in the above table depicted the conditions between 2,220 ft and 3,500 ft above msl over the accident site and these scans "saw" the closest altitudes to the aircraft's altitude before descent.[19]

## 6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[20] it is a function n 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 00-24C[21], "Thunderstorms," dated February 19, 2013, also defines the echo intensity levels and weather radar echo intensity terminology associated with those levels. For decibels (dBZ[22]) 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."

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

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

[19] For more information please see the track data located in the docket for this accident.

[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] 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.

## 6.4 Base Reflectivity and Lightning Data

Figure 10 presents the KOHX WSR-88D base reflectivity images for the 1.5° elevation scan initiated at 1055:06 CDT, with resolution of 0.5° X 250 m. Reflectivity values between 5 and -15 dBZ were located above the accident site at the accident time. There were no lightning flashes[23] near the accident site at the accident time.[24]

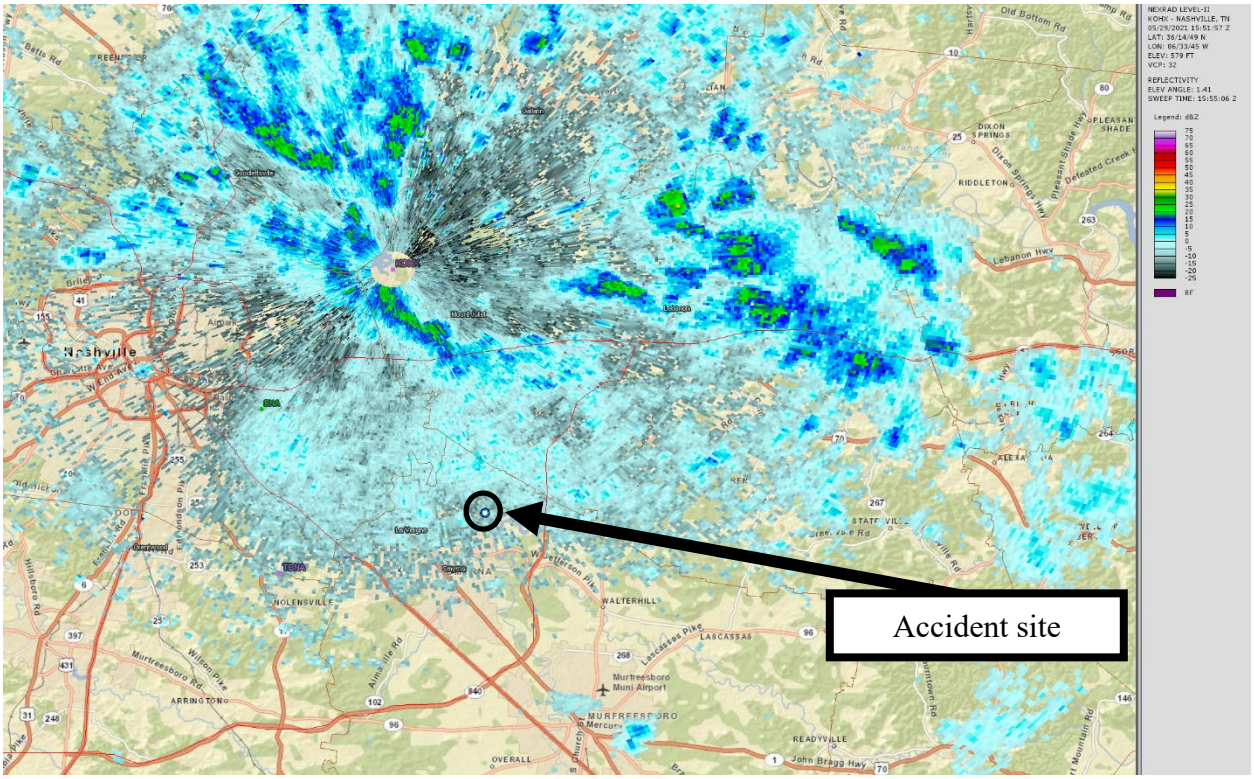



**Figure 10 – KOHX WSR-88D reflectivity for the 1.5° elevation scan initiated at 2058:55 CDT with the accident site marked with a black circle.**

## 7.0 Pilot Reports

The longline-disseminated pilot reports[25] (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

[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.
[25] Only pilot reports with the World Meteorological Organization headers UBTN**, UBKY**, and UBAL** were considered. These do not include pilot reports only broadcast via radio.

Additional PIREPs were requested and disseminated by ATC and those PIREPs can be found in attachment 2. While PIREPs were solicited and distributed within BNA airspace, BNA ATC had difficulty with logging in to the entry point for longline PIREP distribution. Therefore, the PIREPs solicited by BNA controllers found in attachment 2 were not distributed longline.

## 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 Memphis (ZME) 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. ZME CWSU did produce pre-duty weather briefing information for ATC within ZME airspace with the pre-duty weather briefing valid at the accident time released at 0545 CDT (attachment 3).

## 10.0 Airmen's Meteorological Information

There were no Airmen's Meteorological Information (AIRMET) advisories valid for the accident site at the accident time.

## 11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products issued before the accident flight and valid at 1000 CDT are shown in attachment 4. The GFA surface forecast valid before departure for around the accident time indicated VFR surface visibilities 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 overcast ceilings between 1,500 and 2,000 ft msl with cloud tops at 7,000 ft msl. The Graphical AIRMET[26] (G-AIRMET) Sierra for IFR conditions was valid east of the accident site and was overlaid on the GFA surface forecast graphics. The only human-generated information reflected in the two GFA products are the G-AIRMETs. For more information, please see attachment 4.

## 12.0 Terminal Aerodrome Forecast

KMQY was the closest airport to the accident site with an NWS Terminal Aerodrome Forecast[27] (TAF). The KMQY TAF valid at the time of the accident was issued at 0918 CDT and was valid for a 22-hour period beginning at 0900 CDT. The 0918 CDT TAF for KMQY was as follows:

[26] https://aviationweather.gov/gairmet

[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

TAF KMQY 291418Z 2914/3012 **32010KT P6SM OVC012**
**TEMPO 2914/2916 3SM BR**
FM291600 34011G19KT P6SM OVC012
FM292300 36012G21KT P6SM OVC025
FM300400 35008KT P6SM OVC020

For the accident time the forecast expected a wind from 320° at 10 knots, greater than 6 miles visibility, and an overcast ceiling at 1,200 ft agl. Temporary conditions[28] were forecast between 0900 and 1100 CDT of 3 miles visibility and mist.

## 13.0 NWS Area Forecast Discussion

The NWS office in Nashville, Tennessee, (WFO OHX) issued an Area Forecast Discussion (AFD) at 0611 CDT. The aviation section of the AFD discussed MVFR to IFR conditions expected to persist through the accident period with northerly wind gusts to 21 knots:

FXUS64 KOHX 291111
AFDOHX

Area Forecast Discussion
National Weather Service Nashville TN
611 AM CDT Sat May 29 2021

.UPDATE...
FOR 12Z AVIATION DISCUSSION.

&&

.DISCUSSION...

Cold front has moved through middle TN and the upper level low will drag behind and move across the Ohio Valley today. This will result in cloudy skies for the area and patchy morning drizzle for the Plateau. Highs today will be well below normal...upper 50s to mid 60s. Went on the low end of guidance. This means dew points are down too...and overnight lows tonight will only be in the 40s. The warming trend starts on Sunday with mostly sunny skies...low dew points and highs in the mid 60s to lower 70s. Memorial Day looks pleasant with low RH and highs 75-80. Tuesday looks to be a transition day with an upper level elongated trough extending from the Great Lakes to Texas. Pops will be on the rise starting Tuesday.

The extended forecast Wednesday through Saturday is looking unsettled with a broad trough east of the Rockies. Will have pops all days...with likely pops Wednesday night and Thursday. Right now total QPF through the extended will be 1-2" so don/t expect any flooding issues. Temperatures will be near normal for early June.

&&

[28] pd01008013curr.pdf (noaa.gov)

.AVIATION...
12Z TAF DISCUSSION.

Overall poor flying conditions for the whole TAF period. MVFR to IFR expected throughout as low level moisture wraps around the backside of our latest weather system.

Winds will be occasionally breezy with northerly gusts of 18-21 kts until after 00Z/Sun.

&&

.OHX WATCHES/WARNINGS/ADVISORIES...
NONE.

&&

$$

## 14.0 Winds and Temperature Aloft Forecast

The NWS 0857 CDT Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

```
FBUS31 KWNO 291357
FD1US1
DATA BASED ON 291200Z
VALID 291800Z   FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT  3000    6000    9000   12000   18000   24000  30000  34000  39000
BNA 3613 3409+03 3217+02 3120-02 2843-14 2754-23 285539 285749 285258
```

The closest forecast point to the accident site was Nashville, Tennessee (BNA). The 0857 CDT BNA forecast for use between 0900 CDT and 1600 CDT indicated a wind at 3,000 ft from 360° at 13 knots, a wind at 6,000 ft from 340° at 9 knots with a temperature of 3°C, and a wind at 9,000 ft from 320° at 17 knots with a temperature of 2°C.

## 15.0 Pilot Weather Briefing

The accident pilot did not request weather information[29] from Leidos Flight Service.

A search of archived ForeFlight information indicated that the accident pilot did request and receive weather information from ForeFlight at 0817 CDT. For more information see attachment 5. There is no record of the accident pilot receiving or retrieving any other weather information before or during the accident flight.

[29] https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf

## 16.0 Astronomical Data

The astronomical data obtained for the accident site on May 29, 2021, indicated the following:

| **SUN** | |
|---|---|
| Begin civil twilight | 0502 CDT |
| Sunrise | 0531 CDT |
| **Accident time** | **1055 CDT**[30] |
| Sun transit | 1243 CDT |
| Sunset | 1956 CDT |
| End civil twilight | 2025 CDT |

At the time of the accident the Sun was located at an altitude of 62.44° and azimuth of 113.87°.

## E. LIST OF ATTACHMENTS

Attachment 1 – GOES-16 visible imagery animation from 1021 to 1121 CDT

Attachment 2 – Additional ATC PIREPs

Attachment 3 – ZME CWSU pre-duty weather briefing

Attachment 4 – GFA valid for the accident site at accident time

Attachment 5 – ForeFlight Information

Submitted by:

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[30] Inserted accident time for reference and context.